PART 4 SURFACE EQUIPMENT (EHB-8)

4. Equipment Maintenance Schedules. Experience in the operation of electronic equipment has well established that reliable service and accurate data can be obtained only by the application of suitable routine maintenance procedures. Maintenance schedules are prepared for the guidance of electronics technicians and operating personnel, and comprise the minimum periodic checking and servicing considered necessary to assure dependable operation. Checks intended for operating personnel are limited to routine functions that have been identified as those that could ordinarily be observed during the course of normal operation of the equipment. These functions are usually consolidated at the beginning of each maintenance schedule for ease of use, with the remaining sections devoted to the electronics technician functions. The operator functions and electronics technician functions have been printed on contrasting colored pages for ready identification.

Maintenance schedules are prepared with the view of being as complete as possible. Some checks specified are critical as regards calibration and sustained reliable operation. Others fall in a less critical category, and depending upon the technician's work load, can be deferred until later. This criterion is, therefore, the basis for establishing priority maintenance. Priorities indicated on maintenance schedules are to be interpreted as follows:

Priority 1 - This check is important to sustained system operation or calibration and should be performed on schedule.

Priority 2 - This check or operation can be omitted until next scheduled period of maintenance.

Once sufficient familiarity with a system has been obtained, schedules are prepared by the NWS Office of Systems Operations Engineering Division. Tentative schedules are prepared for new equipment. These are then distributed to all electronics technicians and to those stations having that particular equipment. The effectiveness of the schedule is then monitored through the Engineering Management Reporting System (EMRS). Reports of component failures and system reliability then form the basis for any required revision found necessary. Maintenance schedules form an important aspect of the maintenance program and have a significant effect upon the establishment of work load standards and the development of various staffing and dispersion criteria.

As a technician's equipment responsibility periodically changes, he/she should ensure that copies of all available maintenance schedules are available for ready reference. Copies of missing schedules should be requested through the regional headquarters from the NLSC.

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
SILVER SPRING, MD. 20910

January 26, 1976

Office of Technical Services W514

MAINTENANCE SCHEDULE FOR THE CEILING LIGHT EQUIPMENT
(FOR METEOROLOGICAL TECHNICIAN)

WEEKLY

What to Check	How to Check	Precautions & Remarks
1. Lamp and Timer	Turn on lamp. Check to see that it lights. Check to see that timer shuts off,	May be made as part of regular observation. Change lamp if "out". If checks are to be made during daytime, a metal reflector may be placed at top edge of cover so that operation may be observed from the office. Prefocused lamps are used. Do not attempt to refocus projector when only a lamp is changed. Focusing of projector will be accomplished only by ELTECs. Lamp should only be used for measuring cloud heights. Do not leave lamp on over the 5-minute period for making observation.

EHB-8
Issuance 76 - 1

MONTHLY

What to Check	How to Check	Precautions & Remarks
1. Cover Glass	Loosen "C" clamp screws and tilt back cover. Clean the inside of the cover glass with water and detergent.	
2. Mirror	Clean surface of mirror with water and detergent. See that surface is completely dry. Wipe with lint free cloth.	CAUTION: If direct rays from the sun reach the mirror, then shade the projector. The concentrated rays of the sun can burn personnel and equipment.
3. Clinometer	Inspect for proper operation. Check cross wires and clutch on pendulum.	
4. Lamp	Inspect lamp. If lamp envelope has darkened appreciably, the lamp should be changed.	Turn lamp "off" to inspect.

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
SILVER SPRING, MD. 20910

January 26, 1976

Office of Technical Services
Engineering Division W514

MAINTENANCE SCHEDULE FOR THE CEILING LIGHT EQUIPMENT
(FOR ELECTRONICS TECHNICIAN)

DAILY

What to Check	How to Check	Precautions & Remarks
1. Equipment Log	This will apply only at those stations where an ELTEC is stationed. All other stations must report malfunctions in accordance with current instructions.	Take corrective action required.

*QUARTERLY

* NOTE: The required maintenance on the Ceiling Light Projector at other than the home station of the ELTEC should be accomplished at the time of a regular scheduled maintenance trip for other equipment. A special trip should not be made for the Ceiling Light alone unless a malfunction has been reported, and should be made only if no other means of ceiling measurement is available.

1. Line Voltage	Use ac. voltmeter and check input voltage. Should be 120 volts. NOTE: Checking the voltage to the projector should be accomplished at night if possible. The line voltage would be most likely to be lowest due to load.	Use a recently calibrated ac. meter. Lamp should be burning.

QUARTERLY

What to Check	How to Check	Precautions & Remarks
2. Connections	Check and tighten if necessary all the connections.	
3. Wires	Check condition of wires and terminals.	
4. Lamp Socket	Remove lamp. Inspect contacts. Clean if necessary with crocus cloth.	
5. Timer	Check timer for normal operation.	Maximum 3 minutes ± 15 seconds.

ANNUALLY

1. Cover Gasket	Examine cover gasket. Replace.	
2. Level (Housing)	Check that projector housing is properly leveled. Use 4" carpenters' level on both levelling perches. Do not attempt to use K210-M3501 Precision Level. Adjust proper slip fitter screws when re-levelling.	
3. Focus	Required only if someone has tampered with the optical system.	Focusing procedures are outlined in the Ceiling Light Projector Manual, and this manual should be consulted before starting focusing procedures.

MAINTENANCE SCHEDULE INDEX
WIND EQUIPMENT

Date of Issue	Title
September 13, 1980	Maintenance Schedule for the F420 Wind System and Associated Equipment (For Meteorological Technicians)
September 13, 1980	Maintenance Schedule for the F420 Wind System and Associated Equipment (For Electronic Technicians)
February 1988	Maintenance Schedule for the F420N Wind System and Associated Equipment (For Electronic Technicians)
December 7, 1992	Errata No. 1 Pen and Ink changes to the Maintenance Schedules for the F420 and F420N Wind Systems and Associated Equipment.

Engineering Division
OA/W514

MAINTENANCE SCHEDULE FOR THE F420 WIND SYSTEM AND ASSOCIATED EQUIPMENT

(For Meteorological Technicians)

DAILY

What to Check	How to Check	Precautions & Remarks
1. Meters and/or Recorder Operation	Check speed and direction meter and/or recorder for correct indication. Check proper timing on recorder. Refer to Paragraph 4.3.2 and 4.3.3 of Wind Equipment Instruction Manual.	Record apparent malfunction on Log, Form H-10. Recorder time ± minute per day.

WEEKLY

1. Meter and/or Recorder Glass	Clean Glass face.	Use water and non-abrasive detergent or glass cleaner with cheesecloth or other lint-free material.
2. Wind Mast	Visually check to see if obstruction lights are lighted.	Record in Log, Form H-10, if out.
3. Recorder Pen	Refill Inkwell. Remove dirt or lint from pen point.	Do not spill ink on recorder.
4. Wind Speed Output Test	Activate "Test" Switch on front of retranamitter and note values. The master meter reading should be within 1.0 knot of the calibrated teat speed furnished by the El Techs. All other meters should be within 1.5 knots of that specified by the El Tech.	Notify remote locations of impending test. Notify El Tech if reading is out of tolerance and enter on NWS Form H-10.

MAINTENANCE SCHEDULE FOR F420 WIND SYSTEM AND ASSOCIATED EQUIPMENT

(For Electronics Technicians)

NOTE: This Maintenance Schedule is applicable to aviation and synoptic stations only. Cooperative systems need be routinely serviced only on an annual basis.

The two major retransmitters presently in use are the F607 and F611A. When performing checks in this maintenance schedule, care should be exercised in the notations under "Precautions and Remarks" as to which retransmitter is referenced.

DAILY

What to Check	How to Check	Precautions & Remarks
1. Equipment Log	Take corrective action on reported malfunction.	

MONTHLY

	What to Check	How to Check	Precautions & Remarks
1.	Wind Speed Output Test	Activate "Test" switch on front of retransmitter. Obtain meter and recorder indications from all positions.	Notify remote location of impending wind speed test.
	a. F607	Normal indication is in the vicinity of 60 knots.	Master wind speed meter tolerance is ± 1.0 knot of established value. Remote indicator(s) tolerance is ± 1.5 knots. Record values on NWS Form H-17. If error is noted, correct the malfunction as required.
	b. F611	Normal indication is approximately 46.8 knots.	

MONTHLY

What to Check	How to Check	Precautions & Remarks
2. Wind Direction		
a. F607 Retransmitter	Remove A, B, and C input leads to retransmitter. Install cable from Direction Indicator Test Box to A, B, and C on retransmitter. Check all positions as indicated on the test box. Allowable error is ± 5 degrees.	Record values obtained on NWS Form H-17. If error of more than 5 degrees is noted, correct the malfunction as required.
b. F611A	Check Direction Indicator by positioning the Direction Test switch to 70 degrees, 190 degrees, and 310 degrees.	Do not attempt to use the wind direction Test Box on the F611 retransmitter. If an error of more than 5 degrees is noted, correct the malfunction as required. Record values obtained on NWS Form H-17.

QUARTERLY

1.	Cables	Check for cracks, breaks, or deterioration.	Replace as required.
2.	Rack and/or Cabinet	Clean Equipment	
3.	Wind Speed Indicators (Other than Belfort) Remove	Remove input leads to meter and/or recorder. The rest position should be + 2.0 knots.	Adjust threshold for + 2.0 knots if found to be in error.
4.	Wind Direction Meter	Remove A, B, and C input leads. Install cable from direction indicator test box to these inputs. Check all positions as indicated on the test box.	When checking non-standard systems or retransmitter systems verify a defective meter indication by connecting the test box directly to the meter in question.

QUARTERLY

What to Check	How to Check	Precautions & Remarks
4. Wind Direction Meter (Cont'd)	On systems with retrans-mitters, it is preferable to first disconnect the A, B, and C leads at the wind mast from the direction trans-mitter and to connect the test box to the lines at this point so the length of the lines will enter into the check. Allowable error is ± 5 degrees.	Description of standard and non-standard system installation appears in the Instruction Manual for Wind System, Par. 2.2.3, page 6, and par. 2.5 on page 10.
5. Direction Meter Resistance	Check resistance between AB, BC, and AC taps of meter. Should be 82 ohms, ± 8 ohms.	In any one unit, resistance of each leg should not vary more than ± 1.0 ohm. Loss of balance between windings will be indicated by lack of linearity.
6. Indicating Meters	Clean Glass Face.	
7. Rack and/or Cabinet	Clean Equiment.	
8. Recording Inking	Remove pen and inkwell. Flush out both pen and ink-well thoroughly with warm water. Replace ink.	Mark record as out for maintenance. Note time and reset for proper timing when completed.
9. Pen Balance	Check the balance of the pen to obtain a steady inking trace on the chart with the least amount of pressure on the point.	Check balance with the pen full of ink. Balance may be ad-justed by moving the coiled wire weight, or by adjusting nuts at the rear of the pen.

QUARTERLY

What to Check	How to Check	Precautions & Remarks
10. Recorder Zero	Disconnect the input to the recorder and to the master panel meter. Check that the recorder pen rests at the same value as the master panel meter, (+ 2 knots).	The zero adjustment on some models of recorders is done by a zero set screw. On other models of recorders the zero adjustment is made by an adjusting lever.
11. Weather Service Form H-17	Complete and submit through channels.	Make sure form is completed. (See Wind Equipment Maintenance Note No. 32.)

SEMIANNUAL

NOTE: Perform Quarterly Check Before Proceeding with Semiannual Maintenance.

1. Speed Meter Calibration Check	Perform Speed Meter Calibration check in accordance with Para. 8 of Maintenance Note No. 29.	
2. Speed Transmitter		
a. Brushes and Commutator	Disassemble the transmitter case and wipe the commutator clean with a clean, lint-free cloth. Carefully lift the brushes not more than 1/8 inch and slip a narrow strip of cloth between the commutator and brushes. Work the cloth back and forth until all dirt is removed. Check brush tension and adjust if necessary. Tension should be 25 grams + 5 at the	Calibration is required if brush tension is changed.

SEMIANNUAL

What to Check	How to Check	Precautions & Remarks
2. a. Brushes and Commutator (Cont'd)	point where the brushes just lift off the commutator. Tip of gram gage should be just inside the brush block.	
b. Torque	Check starting torque with torque watch. Torque should be less than .35 oz./inch on the F420C, less than .30 oz./inch on the F420D, and less than .60 oz./inch for F420A and B.	Check brush tension and/or bearings for binding. Return defective transmitter to National Reconditioning Center (NRC), Kansas City, Missouri.
c. Terminal Resistance	Check resistance across output with ohmmeter. Should be 40.0 ohms ± 1 ohm.	Reassemble transmitter shell.
d. Bearings		If bearings are the cause of high starting torque as evidenced from previous checks, replace the transmitter and return the defective unit to National Reconditioning Center (NRC), Kansas City, Missouri.
3. Calibration		
a. Speed Transmitter Only	Screw appropriate shaft coupler supplied with Wind Calibrator onto the wind speed transmitter shaft. Connect the transmitter to master panel terminals F and G using special cable supplied. Check that proper polarity is maintained. Operate calibrator at 600 and 900 rpm. Check that master meter agrees with previously established cali-	Recheck calibration after brush ring securing screws have been tightened.

SEMIANNUAL

What to Check	How to Check	Precautions & Remarks
3. a. Speed Transmitter Only (Cont'd)	bration value from column 10 of Form H-17. If reading does not agree, adjust speed transmitter output. This value may differ by the amount of meter error, from Table on Page 15 of Manual. Check for Fluctuations at 600 and 900 CRH Note exceed 1/10 Division.	
b. Systems	After reconnecting the master panel repeat check for the overall system. The loop resistance must enter into the calibration. To calibrate, attach the jumper between socket contact3 at mast support connector. Insert wind speed calibration cable in series with circuit and calibrate as before. All other meters should agree within ± 1.5 knots of values on Page 15 of Manual.	When installing the wind speed transmitter in system after being adjusted into a standard load (428.6 ohms) refer to Item la.(4) under annual checks. An error greater than 1.0 knot or mph. indicates possible line trouble. If error is 1.0 knot or less, adjust generator for established standard meter value. CAUTION: The wind speed transmitter must first be adjusted to a standard load of 428.6 ohms and subsequent adjustments when installed in the system must be made by the padding resistor used in a non-standard system. Do not readjust the transmitter. (Reference Sec. 2.5 and 4.1.2 of EHB 8-200.)

SEMIANNUAL

What to Check	How to Check	Precautions & Remarks
3. c. Gust Recorder	For those systems with gust recorders, the recorders should be on during the system 600 and 900 rpm. wind speed checks. The speed check should be of long enough duration to obtain a usable trace on the gust recorder. These traces should then be checked for accuracy.	Should the gust recorder show an error greater than + 2 knot3 from master panel the recorder should be calibrated in accordance with Esterline-Angus Instruction Sheet #42 or Instruction Manual A6OlC. Range doubling should be checked at this time, if applicable.
d. Retransmitters	A system using magnetic or solid state retransmitters must also be calibrated using the loop resistance as part of the calibration circuit. The 428.6 ohm resistor at the wind mast must be shorted, and subsequent adjustment on the magnetic amplifier must be made by the calibration adjustment on the magnetic amplifier. No adjustment is necessary on the solid state type retransmitter.	Where indicators are connected and switched commonly between more than one remote site, each site should be considered a separate system and calibrations prepared for all. The same Block 9 and 10 entries on NWS Form H-17, however, may be entered on each annual calibration for those meters designated as masters.
4. Direction Transmitter		
a. Torque	Check starting torque with torque watch. Torques should be less than .55 inch ounces on F420C and F420D transmitters.	
b. Electrical Continuity	Check the resistance across pins AB, AC, and BC. Should measure 52.5 ohms ± 7.5 ohms for the F420C and F420D	The resistance should be within ± 1.0 ohms of each other in any one unit.

SEMIANNUAL

What to Check	How to Check	Precautions & Remarks
4. b. Electrical Continuity (Cont'd)	models. Check across pins D and E as the transmitter shaft is rotated. Resistance should not vary more than 2 ohms throughtout entire range.	Look for short or open circuit.
c. Electrical Alignment	Place ohmmeter leads across A and D. Check that the head of the wind vane and the North line scribed on the side of the transmitter are in alignment when the ohm-meter indicates minimum resistance.	Resistance should be less than 2 ohms when at North. See Instruction Manual, Par. 4.2.5. Page 20 for orientation of toroid.
5. Power Supply		
a. Output	Check dc voltage under full load. It should not be less than 10 volts. Check current in D-E loop. It should not be less than 175 ma. The de voltage for a non-standard system may have to be higher than 10 volts. Generally, if the power supply delivers about 14 volts at the remote site, the operation will be satisfactory.	Voltage and current are load dependent. Current will also vary with condition of bearings if the ground brush modifi-cation has not been performed. (See Maintenance Note No. 14, EHB-8, Part 02, Section 2.2.)
b. Loading	If more than four repeaters are used, the load on the transmitter toroid is in-creased where damage may occur. Measure current in D lead and if it exceeds 0.4 amps., add series resistance to reduce current to 0.4 amps.	Do not confuse repeater3 with retransmitters.
6. Weather Service Form H-17	Complete and submit through channels.	Make sure form is completed. (See Wind Equipment Maintenance Note No. 32.)

ANNUAL

What to Check	How to Check	Precautions & Remarks
NOTE: Perform Quarterly Check Before Proceeding with Annual Maintenance		
1. Wind Speed Meters	Check calibration of master panel meter with Meter Test Box and precision portable potentiometer. Record values at standard calibration points and at 10 knot invervals.	Check meter test box battery and replace it if necessary. Check potentiometers for smooth operation. Because the portable potentiometer is no longer issued, an alternate method using a digital voltmeter is shown in attachment 5.
a. Meter Calibration	(1) Disconnect meter to be used for calibration. This should be the meter on the Weather Service Master Panel or other designated master meters.	Meter Test Box can be connected to either the 500-ohm or 1500-ohm taps of the meter.
	(2). Connect meter and portable potentiometer to Meter Test Box. Refer to Figure l-B, of attached diagram.	
	(3) Refer to millivolt values as shown in Blocks 9 and 10 of NWS Form H-17 for corresponding meter values. Enter appropriate meter values in these blocks. Allowable tolerance is ± 1.5 knots.	Meter is normally set at 2.0 knots when at rest and mv values in Blocks 9 and 10 are adjusted accordingly to obtain correct meter reading.
	(4) The Meter Test Box provides a means of obtaining an adjustable current through a windspeed meter. A precision l0-ohm resistor in the circuit provides a convenient means of determining the	

ANNUAL

What to Check	How to Check	Precautions & Remarks
1. a. Meter Calibration (Cont'd)	current passing through the meter by measuring the voltage drop across this resistor. (Example: 3.07 ma x 10 ohms = 30.7 mv = meter full scale (FS)). An accurate means of measuring the voltage drop is by use of a portable potentiometer. Also incorporated in the test box is a precision 600-ohm resistor that will provide a standard load of 428.6 ohms when connected across the 1500-ohm tap of a windspeed meter. This standard load is necessary when checking the wind speed generator. (5) Check meter at 10 knots or mph, and standard calibration points. Record values obtained and compare against Table I or II, attached to this schedule.	
b. Resistance Check	(1) Connect the portable potentiometer across the Meter Test Box 600-ohm resistor terminals. Refer to Figure 1-C (Meter Resistance Check Circuit) of attached diagram. Adjust test box for a reading of 60 mv.	Each mv across the series circuit will represent 10 ohms.
	(2) Without disturbing the the setting of test box, remove portable potentiometer from 600-ohm resistor and place its leads directly across the wind speed meter under test. Read the volt-	This method may also be used to measure the resistance of each 500-ohm precision resistor within the wind speed meter.

ANNUAL

What to Check	How to Check	Precautions & Remarks
1. b. Resistance Check (Cont'd)	age drop across the meter. Reading should be 50 mv ± .5 mv. If not, the meter should be considered defective and replaced.	
2. Direction Orientation	Compute Solar Noon as described in Attachment #6 of this schedule. Remove transmitter from adapter and install orientation device. Align North markings with mast adaptor and tighten orientation device set screw. Loosen adaptor mounting screws. At precisely solar noon, check and adjust, if necessary, by rotating the mast adaptor until the shadow of pin above azimuth plate falls directly over North mark (0 degrees). Tighten mast adaptor set screws and reinstall direction transmitter.	This should be performed on a clear day and only at solar noon, or use the method described in Wind Maintenance Note No. 20. NOTE: An apparent error in direction, after the mounting adapter is orientated, should not be compensated for by readjusting the adaptor.
3. Rack and Tower	Check external grounds with Vibroground. Clean racks internally and externally. Note the condition of tower and guy wires. Lubricate crank mechanism.	
4. F607 Retransmitter		
a. Batteries, Power Supply	Activate test switch and observe value on meter for established value.	Replace batteries, if necessary, taking care to maintain proper polarity.
b. Line Resistance	Using a VOM, measure the resistance of the lines to the field site. In the wind speed circuit, if the loop resistance is more than 4200	The resistance of each A, B, and C line plus the value of Rl in that line must agree with each

ANNUAL

What to Check	How to Check	Precautions & Remarks
4. b. Line Resistance (Cont'd)	ohms, the value of R2 in the retransmitter should be changed so loop resistance, plus R2, is between 38,000 and 46,000 ohms. In the direction circuit, the resistance of each line plus the value of R1 in that line should be between 700 and 900 ohms. If necessary, resistor R1 should be replaced.	other within ± 10 ohms. R1 is a trim potentiometer in some models.
5. Gust Recorder Lubrication		
a. G.E. Recorder	Disconnect power and remove inking assembly. Remove chart drive assembly. Clean gears, pivots, and bearing surfaces with solvent. Place one drop of good grade watch oil on each pivot and gear of reroll unit, the gear trains and the timing drum. Put two drops in opening of reroll spring box cover where it will work into reroll spring without disassembling. Oil pivots and pinion of reroll bobbin.	Do not oil automatic locking device. Do not use an excessive amount of oil.
b. Esterline-Angus AW Recorder	Preliminary step3 are the same as for G.E. Recorder under (a). On recorders using A-C synchronous motors remove cover plate under chart and place a drop of good grade watch oil on each gear and pivot including differential gears and pivots inside case and the winding arbor bearings. On units with spring drive motors, place a drop of oil on all bearings in	Do not oil the inside of synchronous motor. Do not disassemble recorders unless malfunction is indicated.

ANNUAL

What to Check	How to Check	Precautions & Remarks
5. b. Esterline-Angus AW Recorder (Cont'd)	the side plates and the escapement. Place one drop of oil on end of winding shaft.	
6. Weather Service Form H-17	Complete and submit through channels.	Make sure form is completed. (See Wind Equipment Maintenance Note No. 38

TABLE I

METER CALIBRATION VALUES FOR KNOTS INDICATION

MA Input	MV Across 10 Ohms	Knots Indication
.000	0.00	00.0 (No Tolerance)
.307	3.07	10.0
.614	6.14	20.0
.80127	8.0127	26.1*
.921	9.21	30.0
1.228	12.28	40.0
1.535	15.35	50.0
1.6025	16.025	52.2*
1.842	18.42	60.0
2.149	21.49	70.0
2.4038	24.038	78-3*
2.456	24.56	80.0
2.763	27.63	90.0
3.07	30.7	100.0

*Calibration check points for 300, 600, and 900 RPM values.

NOTE: 1. All readings obtained should be ± 1.5 knots.

2. Calibration check points are 2 knots lower than values on Page 15 of Wind Manual because of meter being adjusted to zero.

3. For checking recorder movement, use 1/2 the above input values.

Attachment 1

TABLE II

METER CALIBRATION VALUES FOR MPH INDICATION

MA Input	MV Across 10 Ohms	MPH Indication
.000	0.00	0.0 (No Tolerance)
.267	2.67	10.0
.534	5.34	20.0
.801	8.01	30.0
.80367	8.0367	30.1*
1.068	10.68	40.0
1.335	13.35	50.0
1.602	16.02	60.0
1.6047	16.047	60.1*
1.869	18.69	70.0
2.136	21.36	80.0
2.403	24.03	90.0
2.4083	24.083	90.2*
2.670	26.79	100.0

*Calibration check points for 300, 600, and 900 RPM values.

NOTE: 1. All readings obtained should be ± 1.5 MPH

2. Calibration check points are 2.3 MPH lower than values on Page 15 of Wind Manual because of meter being adjusted to zero.

3. For checking recorder movement, use l/2 the above input values.

Attachment 2

TABLE III

METER CALIBRATION VALUES FOR KNOTS INDICATRION
USING DATA PRECISION #245 DIGITAL MULTIMETER

Voltage Across 1500 Ohms Terminal	Knots Indication	
0	2.0	
	10.0	
.368	20.0	
1.289	30.0	
1.750	40.0	
2.210	50.0	600
2.404	54.2	~~500~~ RPM
2.671	~~60.2~~ 50.0	
3.132	70.0	
3.592	80.0	
3.606	80.3	900 RPM
4.053	90.0	
4.513	100.0	

NOTE: 1. All readings obtained should be ± 1.5 knots.

2. Calibration Test Points at 2 Knot zero.

Attachment 3

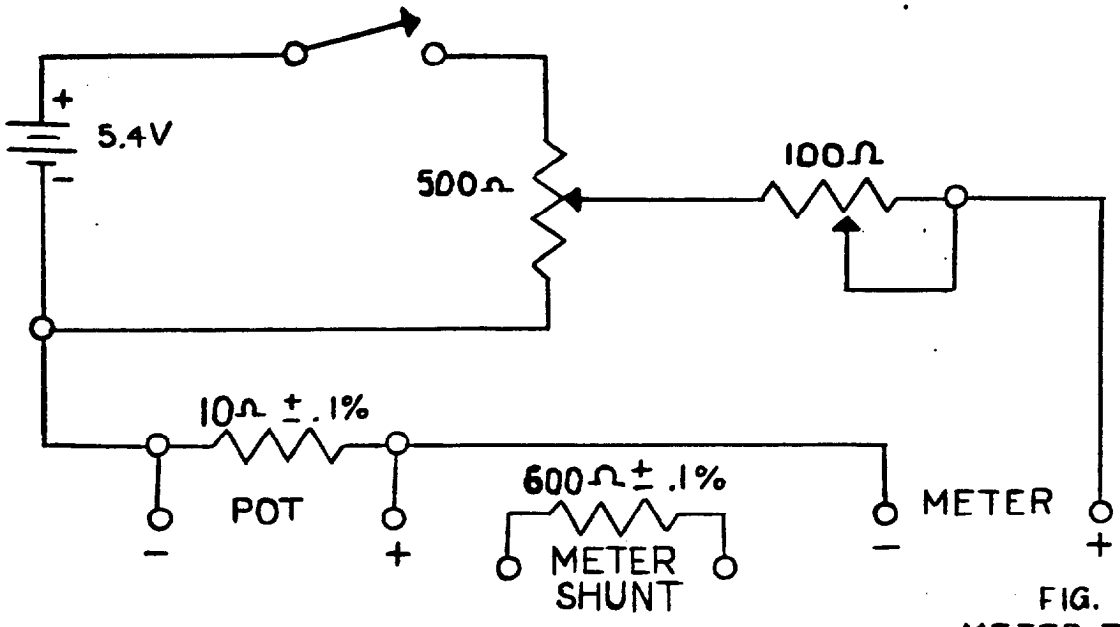


FIG. 1A
METER TEST BOX
SCHEMATIC

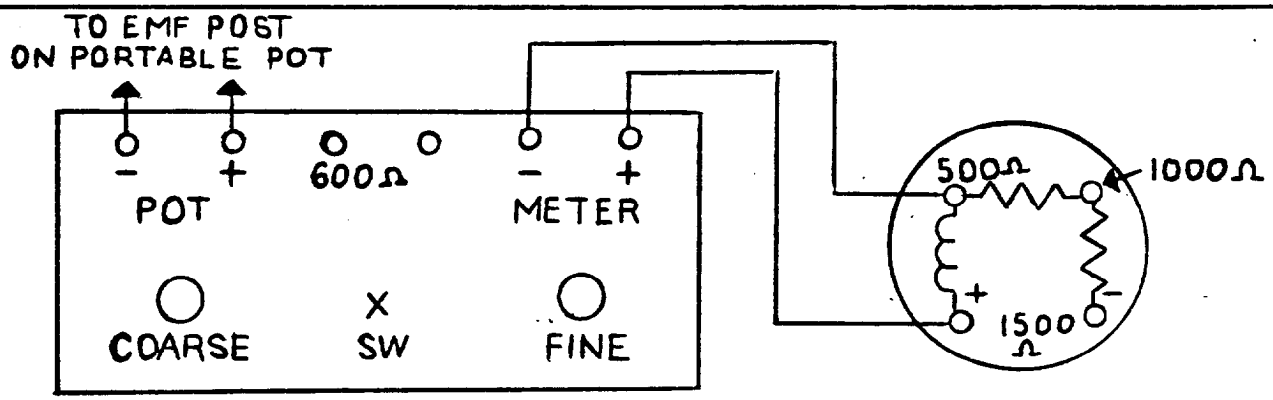


FIG 1B
METER CALIBRATION
CIRCUIT

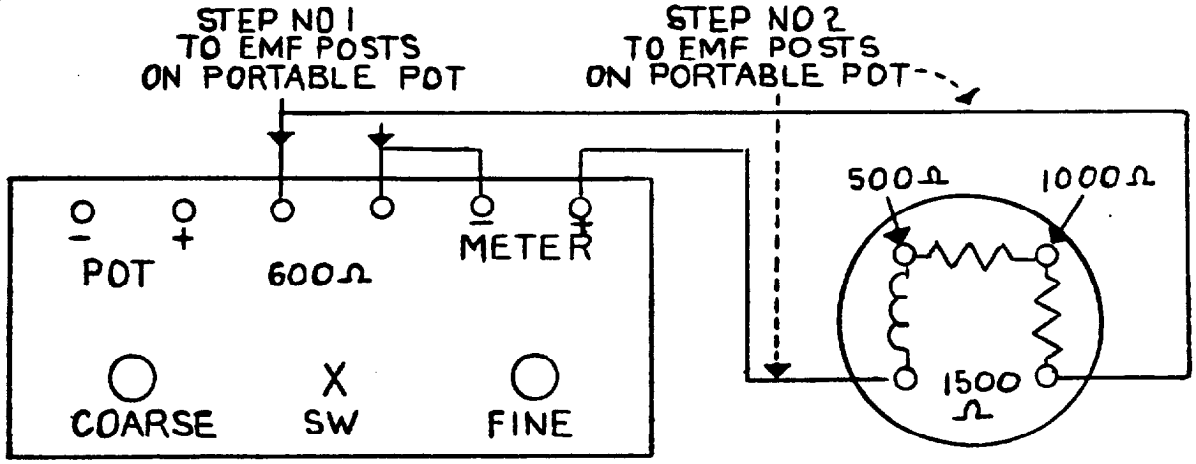
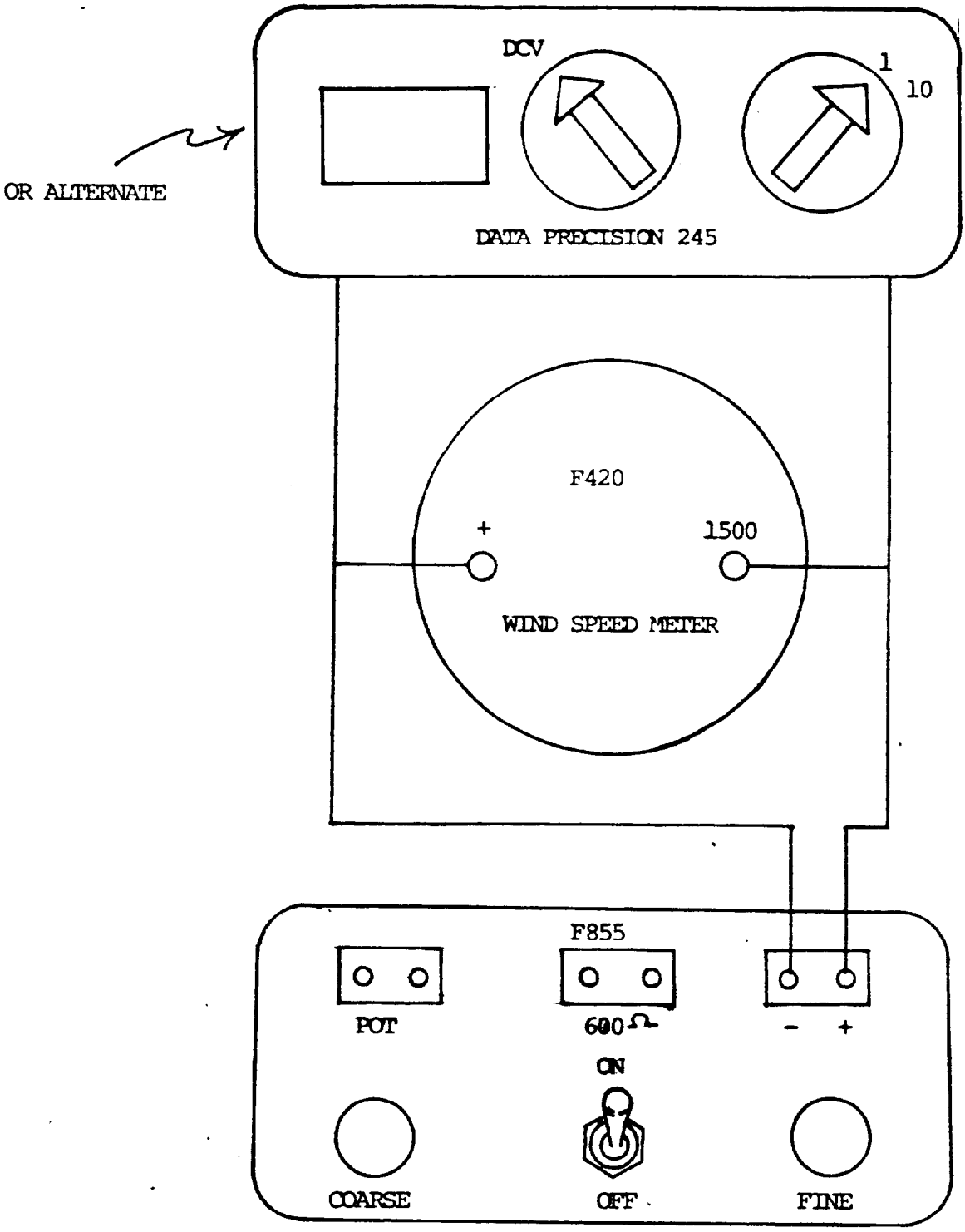


FIG. 1C
METER RESISTANCE
CHECK CIRCUIT

ATTACHMENT # 4



THE F855 CALIBRATOR IS USED AS AN ADJUSTABLE VOLTAGE SOURCE IN THIS CONFIGURATION. A POWER SUPPLY COULD BE SUBSTITUTED.

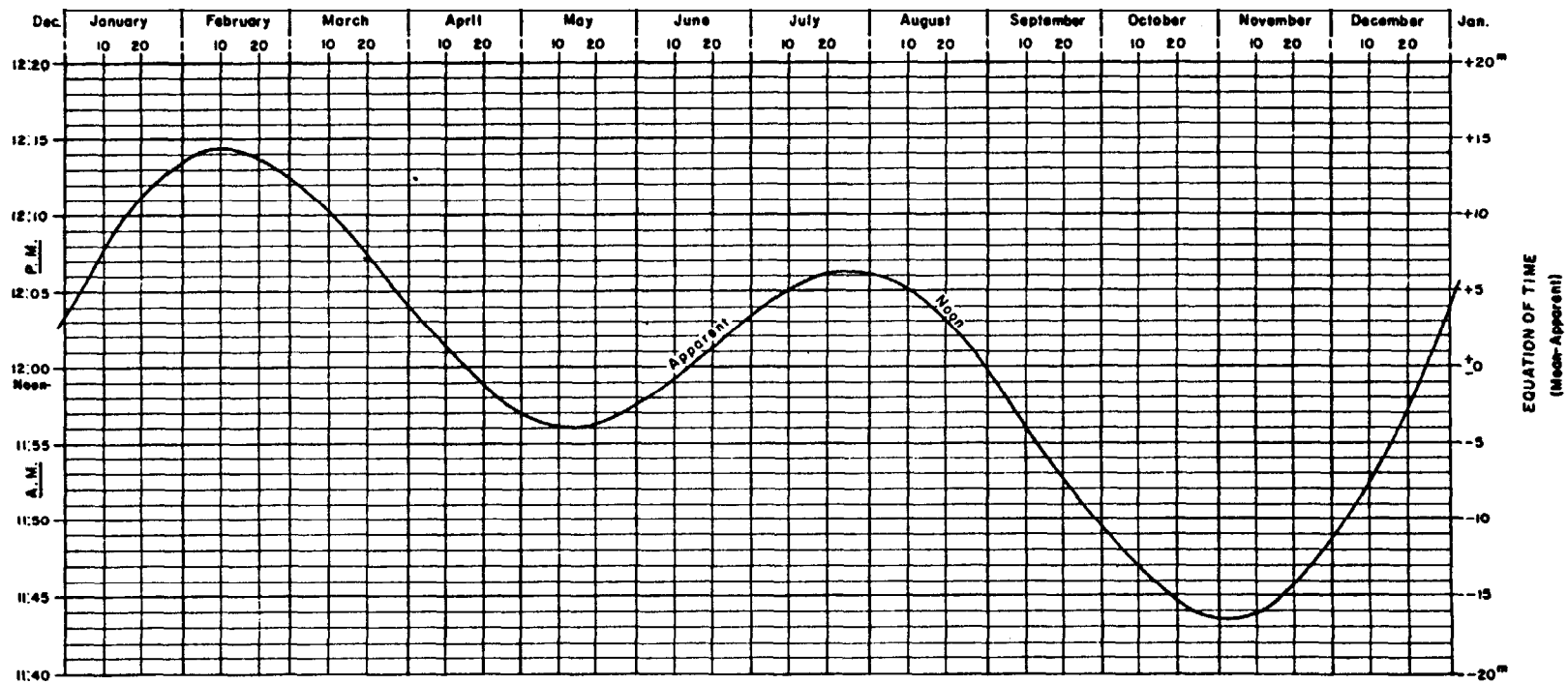
ATTACHMENT #5

(ALTERNATE CALIBRATION METHOD)

RELATION BETWEEN APPARENT NOON AND MEAN TIME

Scale of Days

Standard Time Meridians
E 75th Meridian-Eastern Time
90th Meridian-Central Time
105th Meridian-Mountain Time
120th Meridian-Mountain Time



THIS CHART SHOWS, AT A GLANCE, THE TIME WHEN THE SUN WILL BE ON THE STANDARD MERIDIAN (AT THE LEFT), AND THE EQUATION OF TIME (AT THE RIGHT), FOR ANY DAY IN THE YEAR. A CORRECTION WILL HAVE TO BE MADE FOR THE OBSERVER'S MERIDIAN, IF HIS MERIDIAN IS EAST OR WEST OF THE STANDARD MERIDIAN FOR THE TIME ZONE IN WHICH HE IS STATIONED. THIS CORRECTION AMOUNTS TO FOUR MINUTES FOR EACH DEGREE OF LONGITUDE EAST OR WEST OF THE STANDARD MERIDIAN. IF THE OBSERVER'S MERIDIAN IS EAST OF THE STANDARD MERIDIAN, THE CORRECTION MUST BE SUBTRACTED FROM THE TIME SHOWN ON THE CHART; IF WEST, THE CORRECTION MUST BE ADDED. EXAMPLE: FIND THE TIME THE SUN WILL BE ON THE MERIDIAN AT BOSTON, MASS., ON MARCH 20. ACCORDING TO THE CHART THE SUN WILL CROSS THE 75th MERIDIAN AT 12h 7.5m P.M., E.S.T. THE LONGITUDE OF BOSTON IS 71.07 DEGREES. THE DIFFERENCE BETWEEN BOSTON AND THE STANDARD MERIDIAN (75th) IS 3.93 DEGREES. APPLYING THE CORRECTION OF FOUR MINUTES FOR EACH DEGREE OF DIFFERENCE, 15.7 MINUTES MUST BE SUBTRACTED FROM THE TIME OBTAINED FROM THE CHART, SINCE BOSTON IS EAST OF THE STANDARD MERIDIAN. THEREFORE THE SUN WOULD BE ON THE MERIDIAN AT BOSTON, MARCH 20, AT 11h 51.8m A.M. E.S.T. NOTE THAT THE EQUATION OF TIME IS EQUAL TO THE MEAN TIME MINUS THE APPARENT TIME. THIS CHART IS APPLICABLE TO THE STANDARD MERIDIANS (SEE UPPER RIGHT HAND CORNER).

Attachment # 6

Engineering Division
W/OS0321:WDH

MAINTENANCE SCHEDULE FOR F42DN WIND SYSTEM AND ASSOCIATED EQUIPMENT

(for Electronics Technicians)

NOTE: This Maintenance Schedule is applicable to nonaviation and synoptic stations only. Cooperative systems need be routinely serviced only on an annual basis.

DAILY

What to Check	How to Check	Precautions & Remarks
1. WS Form A-23	Take corrective action on reported malfunction.	

SEMIANNUALLY

What to Check	How to Check	Precautions & Remarks
1. Cables	Check for cracks, breaks, or deterioration.	Replace as required.
2. Rack and/or Cabinet	Clean equipment.	
3. Wind Speed Indicators (Other than Belfort)	Remove input leads to meter and/or recorder. The rest position should be +2.0 knots.	Adjust threshold for +2.0 knots if found to be in error.
4. Wind Direction Meter	Remove A, B, and C input leads. Install cable from direction indicator test box to these inputs. Check all positions as indicated on the test box. Allowable error is + 5 degrees.	When checking non-standard systems, verify a defective meter indication by connecting the test box directly to the meter in question. Description of

SEMIANNUALLY

What to Check	How to Check	Precautions & Remarks
		standard and non-standard system installation appears in the Instruction Manual for Wind System para. 2.2.3, page 6, and para. 2.5 on page 10.
5. Direction Meter Resistance	Check resistance between AB, BC, and AC taps of meter. Should be 82 ± 8 ohms.	In any one unit, resistance of each leg should not vary more than ± 1.0 ohm. Loss of balance between windings will be indicated by lack of linearity.
6. Indicating Meters	Clean glass face.	
7. Rack and/or Cabinet	Clean equipment.	
8. Recording Inking	Remove pen and inkwell. Flush out both pen and inkwell thoroughly with warm water. Replace ink.	Mark record as out for maintenance. Note time and reset for proper timing when completed.
9. Pen Balance	Check the balance of the pen to obtain a steady inking trace on the chart with the least amount of pressure on the point.	Check balance with the pen full of ink. Balance may be adjusted by moving the coiled wire weight or by adjusting nuts at the rear of the pen.
10. Recorder Zero	Disconnect the input to the recorder and to the master panel meter. Check that the recorder pen rests at the	The zero adjustment on some models of recorders is done by a zero-set screw. On

SEMIANNUALLY

What to Check	How to Check	Precautions & Remarks
	same value as the master panel meter (+2 knots).	other models of recorders the zero adjustment is made by an adjusting lever.
11. Speed Meter Calibration Check	Perform speed meter calibration check in accordance with para. 8 of Maintenance Note No. 32.	
12. Speed Transmitter		
a. Torque	Check starting torque with torque watch. Torque should be less than .35 inch-ounces on the F42OC, less than .30 inch-ounces for F42OD.	Check brush tension and/or bearings for binding. Return defective transmitter to National Reconditioning Center (NRC).
b. Bearings		If bearings are the cause of high starting torque as evidenced from previous checks, replace the transmitter and return the defective unit to NRC.
c. Brushes and Commutator	Disassemble the transmitter case and wipe the commutator clean with a clean, lint-free cloth. Carefully lift the brushes not more than l/8 inch and slip a narrow strip of cloth between the commutator and brushes. Work the cloth	Calibration is required if brush tension is changed.

SEMIANNUALLY

What to Check	How to Check	Precautions & Remarks
	back and forth until all dirt is removed. Check brush tension and adjust if necessary. Tension should be 25 ± 5 grams at the point where the brushes just lift off the commutator. Tip of gram gage should be just inside the brush block.	
d. Terminal Resistance	Check resistance across output with ohmmeter. Should be 40.0 ± 1 ohms.	Reassemble transmitter shell.
13. Calibration		
a. Speed Transmitter Only	Screw appropriate shaft coupler supplied with Wind Calibrator onto the wind speed transmitter shaft. Connect the transmitter to master panel terminals F and G using special cable supplied. Check that proper polarity is maintained. Operate calibrator at 600 and 900 rpm. Check that master meter agrees with previously established calibration value from column 10 of form H-17. If reading does not agree, adjust speed transmitter output. This value may differ by the amount of meter error, from table on page 15 of manual.	Recheck calibration after brush ring securing screws have been tightened.
b. Systems	After reconnecting the master panel, repeat check for the overall system. The loop resistance must enter into the calibration. To calibrate, attach the jumper	When installing the wind speed transmitter in system after being adjusted into a standard load (428.6 ohms), refer to

SEMIANNUALLY

What to Check	How to Check	Precautions & Remarks
	between socket contacts at mast support connector. Insert wind speed calibration cable in series with circuit and calibrate as before. All other meters should agree within ± 1.5 knots of values on page 15 of manual.	item la (4) under annual checks. An error greater than 1.0 knot or mph indicates possible line trouble. If error is 1.0 knot or less, adjust generator for established standard meter value. CAUTION: The wind speed transmitter must first be adjusted to a standard load of 428.6 ohms and subsequent adjustments, when installed in the system, must be made by the padding resistor used in a non-standard system. Do not readjust the transmitter. (Reference section 2.5, and 4.1.2 of EHB 8-200.)
c. Gust Recorder	For those systems with gust recorders, the recorders should be on during the system 600 and 900 rpm wind speed checks. The check should be of long enough duration to obtain a usable trace on the gust recorder. These traces should then be checked for accuracy.	Should the gust recorder show an error greater than ± 2 knots from master panel, the recorder should be calibrated in accordance with Esterline-Angus Instruction Sheet #42 or Instruction Manual A601C. Range doubling should be checked at this time, if applicable.

SEMIANNUALLY		
What to Check	How to Check	Precautions & Remarks
14. Direction Transmitter		
a. Torque	Check starting torque with torque watch. Torque should be less than .55 inch ounces on F420C and F420D transmitters.	If bearings are the cause of high starting torque, as evidenced from previous checks, replace the transmitter and return the defective unit to NRC.
b. Electrical Continuity	Check the resistance across pins AB, AC, and BC. Should measure 52.5 ohms ± 7.5 ohms for the F420C and F420D models. Check across pins D and E as the transmitter shaft is rotated. Resistance should not vary more than 2 ohms throughout entire range.	The resistance should be within ± 1.0 ohms of each other in any one unit.' Look for short or open circuit.
c. Electrical Alignment	Place ohmmeter leads across A and D. Check that the head of the wind vane and the North line scribed on the side of the transmitter are in alignment when the ohmmeter indicates minimum resistance.	Resistance should be less than 2 ohms when at North. See Instruction Manual, para. 4.2.5, page 20 for orientation of toroid.
15. Power Supply		
a. output	Check dc voltage under full load. It should not be less than 10 volts. Check current in D-E loop. It should not be less than 175 mA.	Voltage and current are load-dependent. Current will also vary with condition of bearings if the ground brush modification has not been

SEMIANNUALLY

What to Check	How to Check	Precautions & Remarks
15. a. output (cont'd)	The dc voltage for a non-standard system may have to be higher than 10 volts. Generally, if the power supply delivers about 14 volts at the remote site, the operation will be satisfactory.	performed. (See Maintenance Note No. 14, EHB-8, part 02, section 2.2.)
b. Loading	If more than four repeaters are used, the load on the transmitter toroid is increased where damage may occur. Measure current in D lead and if it exceeds 0.4 amps, add series resistance to reduce current to 0.4 amps.	Do not confuse repeaters with retransmitters.
16. Weather Service Form H-17	Complete and submit through channels.	See Wind Equipment Maintenance Note No. 32.

ANNUALLY

What to Check	How to Check	Precautions & Remarks
NOTE: Perform semiannual check before proceeding with annual maintenance.		
1. Wind Speed Meters	Check calibration of master panel meter with Meter Test Box and Digital Voltmeter. Record values at standard calibration points and at lo-knot intervals.	Check meter test box battery and replace if necessary. Calibration method using a digital voltmeter is shown in attachment 2. Calibration values are shown in attachment 1.

ANNUALLY

What to Check	How to Check	Precautions & Remarks
1. a. Meter Calibration	(1) Disconnect meter to be used for calibration. This should be the meter on the Weather Service Master Panel or other designated master meter.	
	(2) Refer to millivolt values as shown in Blocks 9 and 10 of NWS Form H-17 for corresponding meter values. Enter appropriate meter values in these blocks. Allowable tolerance is $\pm$ 1.5 knots.	Meter is normally set at 2.0 knots when at rest and mV values in Blocks 9 and 10 are adjusted accordingly to obtain correct meter reading.
	(3) The Meter Test Box provides a means of obtaining an adjustable current through a wind speed meter. A precision 10-ohm resistor in the circuit provides a convenient means of determining the current passing through the meter by measuring the voltage drop across this resistor. (Example: 3.07 mA x 10 ohms=30.7 mV = meter full scale (FS)). An accurate means of measuring the voltage drop is by use of a digital voltmeter.	
	(4) Check meter at 10 knots and standard calibration points. Record values obtained and compare against table I attached to this schedule.	

ANNUALLY		
What to Check	How to Check	Precautions & Remarks
b. Resistance Check	Place digital voltmeter leads directly across the meter under test. Read the voltage drop across the meter. Reading should be 50 ± .5 mV. If not, the meter should be considered defective and replaced.	This method may also be used to measure the resistance of each 500-ohm precision resistor within the wind speed meter.
2. Direction Orientation	Compute Solar Noon as described in attachment #5 of this schedule. Remove transmitter from adapter and install orientation device. Align North markings with mast adapter and tighten orientation device set screw. Loosen adaptor mounting screws. cisely solar noon, check and adjust, if necessary, by rotating the mast adaptor until the shadow of pin above azimuth plate falls directly over North mark (0 degrees). Tighten mast adaptor set screws and reinstall direction transmitter:	This should be performed on a clear day and only at solar noon; or use the method described in Wind Maintenance Note No. 20. NOTE: An apparent-error in direction, after the mounting adaptor is oriented should not be compensated for by readjusting the adaptor.
3. Rack and Tower	Check external grounds with Vibroground. Clean racks internally and externally. Note the condition of tower and guy wires. Lubricate crank mechanism.	

ANNUALLY			
	What to Check	How to Check	Precautions & Remarks
4.	Gust Recorder Lubrication		
a.	G.E. Recorder	Disconnect power and remove inking assembly. Remove chart drive assembly. Clean gears, pivots, and bearing surfaces with solvent. Place one drop of good grade watch oil on each pivot and gear of reroll unit, the gear trains and the timing drum. Put two drops in opening of reroll spring box cover where it will work into reroll spring without disassembling. Oil pivots and pinion of reroll bobbin.	Do not oil automatic locking device. Do not use an excessive amount of oil.
b.	Esterline-Angus AW Recorder	Preliminary steps are the same as for G.E. Recorder under (a). On recorders using A-C synchronous motors, remove cover plate under chart and place a drop of good grade watch oil on each gear and pivot including differential gears and pivots inside case and the winding arbor bearings. On units with spring drive motors, place a drop of oil on all bearings in the side plates and the escapement. Place one drop of oil on end of winding shaft.	Do not oil the inside of synchronous motor. Do not disassemble recorders unless malfunction is indicated.
5.	Weather Service Form H-17	Complete and submit through channels.	See Wind Equipment Maintenance Note No. 32.

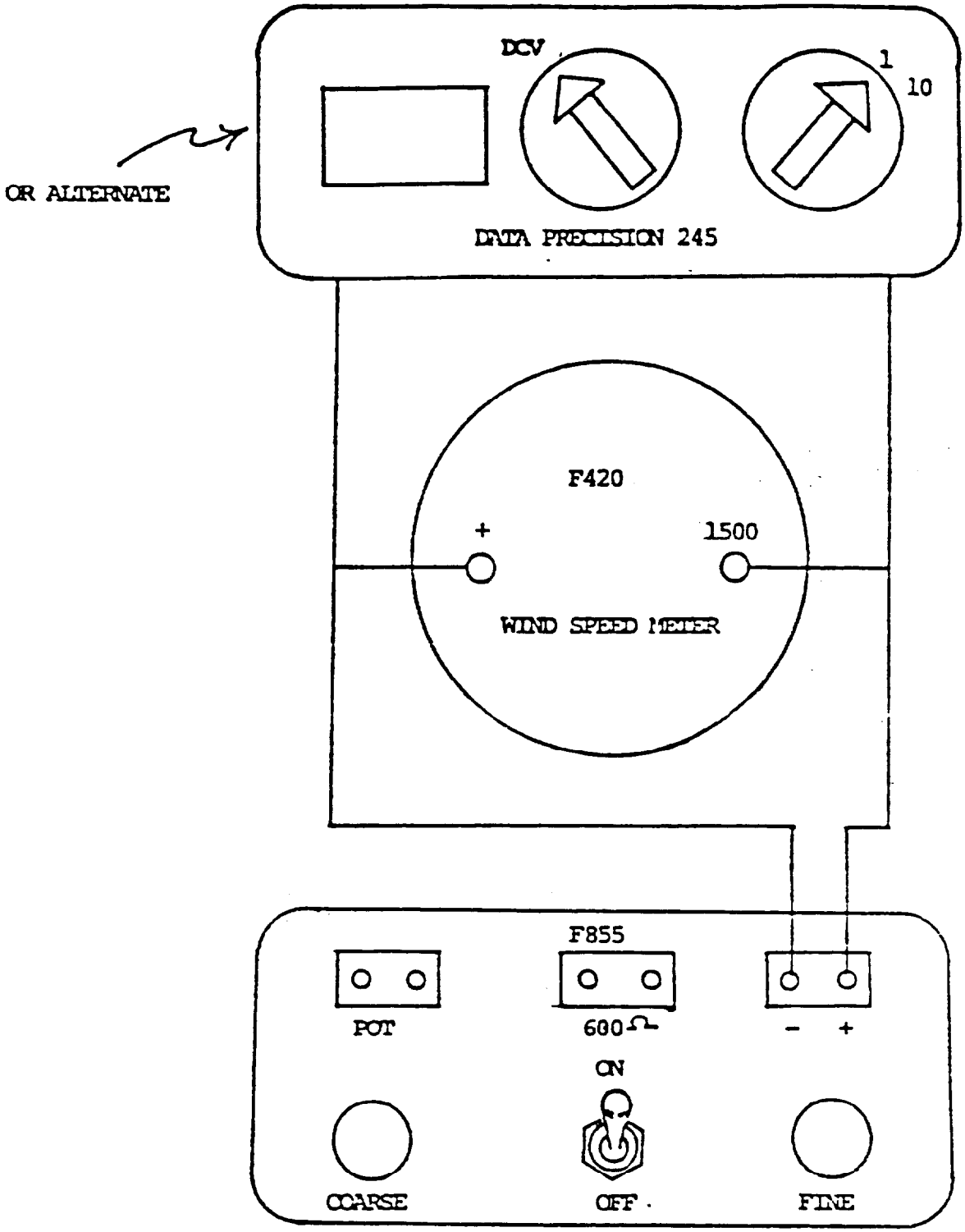
TABLE I

METER CALIBRATION VALUES FOR KNOTS INDICATION
USING DATA PRECISION #245 ,DIGITAL MULTIMETER OR EQUIVALENT

Voltage Across 1500 ohms Terminal	Knots Indication	
0	2.0	
.368	10.0	
.829	20.0	
1.289	30.0	
1.750	40.0	
2.210	50.0	
2.404	54.2	600 RPM
2.671	60.0	
3.132	70.0	
3.592	80.0	
3.606	80.3	900 RPM
4.053	90.0	
4.513	100.0	

NOTE:
1. All readings obtained should be ± 1.5 knots.
2. Calibration Test Points at 2 Knot zero.

ATTACHMENT 1

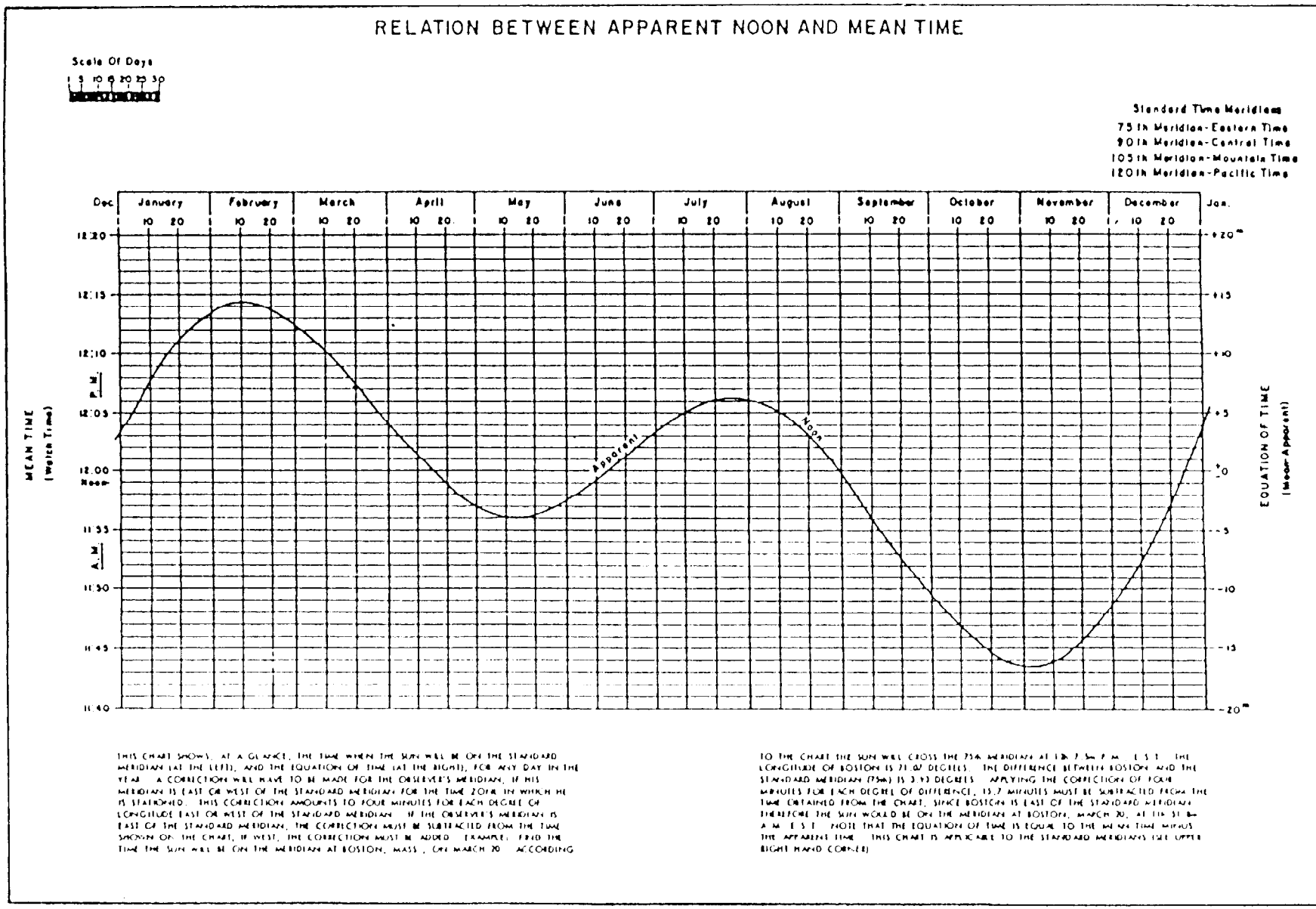


THE F855 CALIBRATOR IS USED AS AN ADJUSTABLE VOLTAGE SOURCE IN THIS CONFIGURATION. A POWER SUPPLY COULD BE SUBSTITUTED.

ATTACHMENT 2

DIGITAL VOLTMETER CALIBRATION METHOD

RELATION BETWEEN APPARENT NOON AND MEAN TIME



THIS CHART SHOWS, AT A GLANCE, THE TIME WHEN THE SUN WILL BE ON THE STANDARD MERIDIAN (AT THE LEFT), AND THE EQUATION OF TIME (AT THE RIGHT), FOR ANY DAY IN THE YEAR. A CORRECTION WILL HAVE TO BE MADE FOR THE OBSERVER'S MERIDIAN, IF HIS MERIDIAN IS EAST OR WEST OF THE STANDARD MERIDIAN FOR THE TIME ZONE IN WHICH HE IS STATIONED. THIS CORRECTION AMOUNTS TO FOUR MINUTES FOR EACH DEGREE OF LONGITUDE EAST OR WEST OF THE STANDARD MERIDIAN. IF THE OBSERVER'S MERIDIAN IS EAST OF THE STANDARD MERIDIAN, THE CORRECTION MUST BE SUBTRACTED FROM THE TIME SHOWN ON THE CHART, IF WEST, THE CORRECTION MUST BE ADDED. EXAMPLE: FIND THE TIME THE SUN WILL BE ON THE MERIDIAN AT BOSTON, MASS., ON MARCH 20. ACCORDING TO THE CHART THE SUN WILL CROSS THE 75th MERIDIAN AT 12h 7.5m P.M. E.S.T. THE LONGITUDE OF BOSTON IS 71.07 DEGREES. THE DIFFERENCE BETWEEN BOSTON AND THE STANDARD MERIDIAN (75th) IS 3.93 DEGREES. APPLYING THE CORRECTION OF FOUR MINUTES FOR EACH DEGREE OF DIFFERENCE, 15.7 MINUTES MUST BE SUBTRACTED FROM THE TIME OBTAINED FROM THE CHART, SINCE BOSTON IS EAST OF THE STANDARD MERIDIAN. THEREFORE THE SUN WOULD BE ON THE MERIDIAN AT BOSTON, MARCH 20, AT 11h 51.8m A.M. E.S.T. NOTE THAT THE EQUATION OF TIME IS EQUAL TO THE MEAN TIME MINUS THE APPARENT TIME. THIS CHART IS APPLICABLE TO THE STANDARD MERIDIANS (SEE UPPER RIGHT HAND CORNER)

ATTACHMENT 3

WS FORM H-17
m-401

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMIN.
NATIONAL WEATHER SERVICE

1. STATION

2. DATE

3. CALIBRATED BY (Name and title)

WIND CALIBRATION DATA SHEET

(Prescribed by Wind Equipment Maintenance Note No. 32)

INSTRUCTIONS: Prepare quarterly. Submit white copy to Regional Headquarters, yellow copy to AES, and retain salmon copy for station records

4. EQUIPMENT AND SYSTEM TYPE:

☐ F 420C ☐ F 4200 ☐ MAG AMP ☐ SOLID STATE ☐ NON-STANDARD

5. DATE LAST CAL.

6. RETRAN. S/N

METER TOLERANCE
Master +1.0 knot Repeater +1.5 knot

7. MONTHLY SPEED COMPARISON DATA *(Retransmitters)*

CALIBRATED TEST SPEED	LOCATION							
	DATE	NWS						
REMARKS								

8. WIND SPEED METER CALIBRATION *(Obtained with calibrator) Tolorance* +1.5

RPM	LOCATION (Check)								RPM	LOCATION (Final)							
	NWS									NWS							
0									0								
300									300								
600									600								
900									900								
1800									1800								

9. WIND SPEED METER CALIBRATION *(Obtained with standard potentiometer)*

Knot	2.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
MV ACROSS 10 OHMS	0.0	2.46	5.53	6.60	11.67	14.74	17.81	20.88	23.95	27.02	30.09
METER INDICATION											
ERROR											

10. MASTER PANEL METER CALIBRATION
(Obtained with standard potentiometer)
(Master or primary) Tolerance ±1.5

RPM	INPUT MA	MV ACROSS 10 OHMS	METER INDICATION
0	0.000	0.000	
300	0.801	8.01	
600	1.603	16.03	
900	2.404	24.04	
1600	4.809	48.09	

11. SYSTEM MEETS STANDARDS ☒ YES ☐ NO

12. WIND SPEED TRANS. IN USE S/N: SPARE

STARTING TORQUE: IN USE IN. OZ. SPARE IN. OZ.

13. WIND DIRECTION TRANSMITTER

A - B = Ohms
A - C = Ohms
B - C = Ohms

Tolerance = 50 ohms +5.0

NORTH ELECTRIAL ALIGNMENT

A-D = _____ Ohms < (2 ohms)

REVIEWED BY:	SIGNATURE	TITLE	DATE

14. DIRECTION TRANSMITTER S/N:	IN USE	SPARE	STARTING TORQUE:	IN USE IN. OZ.	SPARE IN. OZ.

15. WIND DIRECTION COMPARISON DATA: DIRECTION ORIENTATION CHECKED: ☐ YES ☐ NO

DATE		NWS							
☐ DIRECTION METER ONLY	0								
	30								
	60 / 70								
	90								
☐ RETRANSMITTER	120								
	150								
	180 / 190								
☐ MAGNETIC DECLINATION	210								
	240								
	270								
☐ DEGREES DECLINATION	300 / 310								
	330								

DATE		NWS							
☐ DIRECTION METER ONLY	0								
	30								
	60 / 70								
	90								
☐ RETRANSMITTER	120								
	150								
	180 / 190								
☐ MAGNETIC DECLINATION	210								
	240								
	270								
☐ DEGREES DECLINATION	300 / 310								
	330								

DATE		NWS							
☐ DIRECTION METER ONLY	0								
	30								
	60 / 70								
	90								
☐ RETRANSMITTER	120								
	150								
	180 / 190								
☐ MAGNETIC DECLINATION	210								
	240								
	270								
☐ DEGREES DECLINATION	300 / 310								
	330								

REVIEWED BY:	SIGNATURE	TITLE	DATE

WS FORM H-17 (8-80)

ERRATA SHEET 1 (for Electronics Technicians)
Engineering Division
W/OS0321:BGM

Pen-and-ink changes to the Maintenance Schedules for the F420 and F420N Wind Systems and Associated Equipment.

General

This errata sheet provides changes to the F420 and F420N wind system maintenance schedules, section 4.2.

Procedure

Make the following pen-and-ink changes to the F420 maintenance schedule.

1. Page 4, SEMIANNUAL Step 2a, Precautions & Remarks, delete "Calibration is required if brush tension is changed." Add "Inspect commutator and brushes for wear" and "Return defective unit to NRC."

2. Pages 4-5, Step 2a, How to Check, delete the last three sentences. Add "With the transmitter connected to the master panel terminals F and G using special cable supplied, spin the transmitter by hand until the wind speed indicator panel displays approximately 20 MPH. Observe the wind speed pointer descends smoothly without fluctuations or jitter. Fluctuation should not exceed one-half of a graduation on the meter. Observe the cups come to a smooth stop."

3. Page 5, Step 2b, How to Check, add period after F420D. Delete "and less than .60 oz./inch for F420A and B." From Precautions & Remarks, first sentence, delete "brush tension and/or."

4. Page 5, Step 3, How to Check, add the following after the last sentence "Check for fluctuation at 600 and 900 RPM not to exceed ± l/2 division."

Make the following pen-and-ink changes to the F420N maintenance schedule.

1. Page 3, SEMIANNUALLY Step 12a, Precautions & Remarks, first sentence, delete "brush tension and/or."

2. Page 3, Step 12c, Precautions & Remarks, delete "Calibration is required if brush tension is changed." Add "Inspect commutator and brushes for wear" and "Return defective unit to NRC."

3. Page 4, Step 12c, How to Check, delete the last three sentences. Add "With the transmitter connected to the master panel terminals F and G using special cable supplied, spin the transmitter by hand until the wind speed indicator panel displays approximately 20 MPH. Observe the wind speed pointer descends smoothly without fluctuations or jitter. Fluctuation should not exceed one-half of a graduation on the meter. Observe that the cups come to a smooth stop."

4. Page 4, Step 13, How to Check, add the following after the last sentence "Check for fluctuation at 600 and 900 RPM not to exceed ± 1/2 division."

Effect on Other Instructions - None.

J. Michael St. Clair
Chief, Engineering Division

WS FORM H-17 (8-80)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMIN.
NATIONAL WEATHER SERVICE

WIND CALIBRATION DATA SHEET

(Prescribed bv Wind Equipment Maintenance Note No. 32)

1. STATION

2. DATE

3. CALIBRATED BY (Name and title)

INSTRUCTIONS Prepare quarterly. Submit white copy to Regional Headquarters, yellow copy to AES, and retain salmon copy for station records.

4. EQUIPMENT AND SYSTEM TYPE

☐ F402C ☐ F4200 ☐ MAG AMP ☐ SOLID STATE ☐ NON-STANDARD

5. DATE LAST CAL

6. RETRAN S/N

MONTHLY SPEED COMPARISON DATA *(ReTransmitters)*

METER TOLERANCE
Master ±1.0 knot Repeater ± 1.5 knot

REMARKS	LOCATION							
	DATE	NWS						

8. WIND SPEED METER CALIBRATION (Obtained with calibrator) Tolerance ±1.5

RPM	LOCATION (Check) NWS	RPM	LOCATION (Final) NWS
0		0	
300		300	
600		600	
900		900	
1800		1800	

9. WIND SPEED METER CALIBRATION *(Obtalned with standard potentiometer)*

KNOT	2.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
MV ACROSS 10 OHMS	0.0	2.46	5.53	8.60	11.67	14.74	17.81	20.88	23.95	27.02	30.09
METER INDICATION											
ERROR											

10. MASTER PANEL METER CALIBRATION
(Obtained with standard potentiometer)
(Master or primary) Tolerance ± 1.5

RPM	INPUT MA	MV ACROSS 10 OHMS	METER INDICATION
0	0.000	0.000	
300	0.801	8.01	
600	1.603	16.03	
900	2.404	24.04	
1800	4.809	48.09	

11. SYSTEM MEETS STANDARDS ☐ YES ☐ NO

12. WIND SPEED TRANS S/ N

IN USE

SPARE

STARTING TORQUE

IN USE IN. 0Z.

SPARE IN. OZ.

13. WIND DIRECTION TRANSMITTER

A–B = _____ Ohms

A–C = _____ Ohms

B–C = _____ Ohms

Tolerance = ~~50~~ ohms ~~±5.0~~ 52.5 ±2.5

NORTH ELECTRICAL ALIGNMENT

A-D = _____ Ohms (< 2 ohms)

REVIEWED BY:	SIGNATURE	TITLE	DATE

14. DIRECTION TRANSMITTER S/N			IN USE	SPARE	STARTING TORQUE		IN USE IN.OZ.	SPARE IN.OZ.	
15. WIND DIRECTION COMPARISON DATA				DIRECTION ORIENTATION CHECKED			YES	NO	
		NWS							
DIRECTION METER ONLY	0								
	30								
	60 / 70								
	90								
RETRANSMITTER	120								
	150								
	180 / 190								
MAGNETIC DECLAINATION	210								
	240								
	270								
	300 / 310								
DEGREES DECLINATION	330								
DATE		NWS							
DIRECTION METER ONLY	0								
	30								
	60 / 70								
	90								
RETRANSMITTER	120								
	150								
	180 / 190								
MAGNETIC DECLINATION	210								
	240								
	270								
	300 / 310								
DEGREES DECLINATION	330								
DATE		NWS							
DIRECTION METER ONLY	0								
	30								
	60 / 70								
	90								
	120								
	150								
RETRANSMITTER	180 / 190								
	210								
	240								
MAGNETIC DECLINATION	270								
	300 / 310								
DEGREES DECLINATION	330								
REVIEWED	SIGNATURE				TITLE			DATE	

MAINTENANCE SCHEDULE INDEX - RADIATION EQUIPMENT

Date of Issue	Title
June 9, 1959	Maintenance of Photoelectric Sunshine Switch
July 3, 1963.	Maintenance Schedule for Dobson Ozone Spectrophotometer
August 15, 1963	Installation and Operation of Photoelectric Sunshine Switch
September 16, 1964	Maintenance Schedule for Solar Radiation Equipment

All previous schedules have been deleted.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

September 16, 1964

Facilities and Maintenance Division **A-7.4**

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

DAILY

What to Check	How to Check	Precautions & Remarks
1. station Log	Take corrective action on reported malfunctions.	
2. Pyrheliometer (Hemispheric (HS))	Clean bulb (preferably in the morning) with soft clean dry cloth.	Avoid scratching the surface. During period8 of frost or subfreezing temp. refer to par. D1441 of "Manual of Radiation Observations" for special procedure. It should be noted that all types of pyrheliometers are delicate instruments and should always be handled with care.
3. Pyrheliometer (Normal Incident (NI))		
(a) Window	Clean with soft paper tissue (lens tissue). Check for evidence of air leakage or loose window. Leakage is evidenced by water vapor accumulation and should be reported to the Regional office.	Use care to avoid scratching. Do not remove window or loosen retaining ring.
(b) Cable	Check leads and untwist before excessively twisted by rotating equatorial mount drive shaft CCW.	Should be turned back once every 24 hours.

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

DAILY- Continued

What to Check	How to Check	Precautions & Remarks
(c) Tracking	Check orientation and adjust as often as required to keep sun spot on black-dot target. Should remain within 3/16" of black-dot between checks.	If adjusted, notation as to time must be entered on WB Form 610-9.
4. Recorder		
(a) Standardization	Manually operate standardizing button until pen trace is stable.	This should be performed after radiation indication is up to 10-15 ordinates or within two hours after sunrise if the pen does not reach this value.
(b) chart	Examine quality of record and check that time is within ±2 min.	
5. Integrator	Check for normal operation. Totalizing counter should turn on and off periodically twice each minute.	

WEEKLY

1. Pyrheliometer Level (Hemispheric)	Check spirit level for proper level of sensor. If required, adjust the two leveling screws.	Under no circumstances should adjustment of the spirit level itself be attempted since the optical level may differ from the mechanical level of the horizontal plate.

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

WEEKLY - Continued

What to Check	How to Check	Precautions & Remarks
a. Equatorial Mount Clutch	When realigning NI pyrheliometer cheek clutch action. Correct adjustment is when weight of pyrheliometer does not move clutch but still. can be rotated by hand.	
3. Recorder		
(a) Battery	Note position of battery indicator or for indication of erratic pen movement after completion of standardization cycle.	If pen continues to drive to top of scale, new battery is required. Anew Columbia Gray Labe1 battery will be automatically supplied every 4 months by the Regional Office. The batteries should be installed upon receipt.
(b) Pen	Check condition of pen and ink level. Clean and refill as required.	

QUARTERLY

1. Recorder		
(a) Battery	Check installation date of Columbia Gray Label battery. Should not exceed a period of 4 months previous to date of quarterly check. If over this period new battery should be installed.	
(b) Chart Mechanism	Check for proper alignment and feed of paper. If	

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

QUARTERLY - Continued

What to Check	How to Check	Precautions & Remarks
	corrective action required, the ELPEC concerned should be notified. Adjustments to the chart should be made with reference to the appropriate instruction manual.	

SEMIANNUAL

1. Pyrheliometer		
(a) Hemispheric (HS)		
(1) Condition	Check for any appreciable flaking of the magnesium oxide coating.	While slight flaking has not resulted in serious changes in calibration, any such indication should be called to the attention of the Regional Office.
(2) Location	Examine for possible exposure changes. If recorded data is questionable, relocation of exposure site may be required.	
(3) Cabling	Check connections for tightness; cable for signs of insulation deterioration or wear. Check that cables are neatly dressed and free from undue strains.	

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

SEMIANNUAL- Continued

What to Check	How to Cheek	Precautions & Remarks
(b) Normal Incident (NI)		
(1) Condition	Check for cleanliness, mounting clamps, and filter wheel operation if included with unit.	
(2) Location	Check in accordance with semiannual step l-a-2 above.	
(3) Cabling	Check in accordance with semiannual step l-a-3 above.	
(a) Resistance	Measure resistance between positive and negative leads. For the three most common sensors used, the indicated value should be approximately as follows: 1. 10-junction - 35 ohms. 2. 50-junction - 100 ohms. 3. Normal Incident - 450 Ohms. Measure resistance between the positive lead and sensor base. An open indication should be observed. All resistance values obtained should be entered on "Radiation Recorder Calibration Data Sheet."	The Regional Office should be advised immediately of any appreciable variation from there values.
2. Equatorial Mount		
(a) Lubrication	Remove backplate. Oil motor with low temperature oil. Clean gear train and grease with Beacon 325.	

SEMIANNUAL-Continued

What to Check	How to Check	Precautions & Remarks
(b) Operation	Check mounting hardware, movable controls and lubricate as required. Check overall condition and operation.	
3. Recorder		
(a) Calibration	Perform semiannual calibration. The radiation recorder calibration data sheet and recorder records should be forwarded in accordance with existing instructions.	Refer to "Instructions for Calibrating Solar Radiation Recorders" dated 10/11/49 for procedures.
(b) Lubrication	Lubricate recorder in accordance with instructions contained in the Brown "Instruction Manual for Installation, Operation and Maintenance", for circular and strip chart recorders.	These are contained in manuals number 15028G and 15038G respectively.
(c) Amplifier Sensitivity	Sensitivity control (R11) should be adjusted to a point where the motor pinion just ceases to oscillate. If no oscillation occur8 as the adjustments turned CW, the correct sensitivity setting is at full CW position.	Recorder sensitivity should be checked at several points on the scale to be sure there is no oscillation at any position. Non-sensitivity may be caused by weak or defective amplifier tubes. These should be check and replaced as required.
(d) Slidewire	Remove slidewire cover* Lift contact guide away from drum and remove.	If the slidewire has been operated in an oil bath, the used

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

SEMIANNUAL - Continued

What to Check	How to Check	Precautions & Remarks
	Clean s1idewire unit and contactor with stiff bristle brush and c1eaners naphtha, 88-25 Solvent Degreaser or equivalent.	immersion oil should be replaced with new oil whenever slide-wire is cleaned.
(e) Electrical and Mechanical Components	Check resistors, capacitors, eta., for abnormalities. Clean chassis with electric blower; check structural hardware for tightness.	
4. Integrator		
(a) Calibration	Perform semiannual calibrations in accordance with instructions contained in Section III of "Instruction Manual for Solar Radiation Integrating System" dated April-1956.	
(b) Counter Gear Train	Examine unit for dirt and dust. Clean gears with a brush or lint-free cloth.	
(a) Stationary and Movable Brasher	Check the stationary and movable brushes and scanning disk of the scanning assembly for dust and dirt. Clean the brushes with a lint-free cloth. Examine physical condition of brushes. Replace brushes that are worn excessively or have broken or bent fingers. Clean the peripheral surface of the scanning disk taking care to remove all dirt and grime from the contact portion of the disk.	Care should be taken not to bend or warp the fingers on the brush ends. Do not remove brushes to clean as such action may change the calibration of the integrater.

MAINTENANCE SCHEDULE FOR SOLAR RADIATION EQUIPMENT

ANNUAL

What to Check	How to Check	Precautions & Remarks
1. Grounds	Check external ground with Vibroground. Tighten all mechanical connections. Indicate ohm value obtained on "Radiation Recorder Calibration Data Sheet."	

USCOMM-WB-DC

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

July 15, 1963

IN REPLY PLEASE ADDRESS
CHIEF, U.S. WEATHER BUREAU
WASHINGTON, D.C.
AND REFER TO

MULTIPLE ADDRESS LETTER No. 35-63

0-3.4

To : All RAO's, ELTEC's, PSO, Honolulu, WBAS, San Juan, and Dobson Ozone Spectropnotometer Stations

FROM : Chief, Instrumental Engineering Division

SUBJECT: Routine Maintenance of Dobson Ozone Spectrophotometer

REFERENCE: Maintenance Schedule for Dobson Ozone Spectrophotometer, dated July 3, 1963, Attached

The reference maintenance schedule, prepared for the guidance of the electronic technicians and station personnel, comprises the minimum periodic checking, servicing, and calibrating considered necessary to assure dependable operation and accurate data from the subject equipment. In instances where local conditions or the characteristics of the individual instrument cause abnormally frequent malfunctioning, the schedule should be augmented to ensure the achievement of the required performance level.

Routine spectrophotometer tests should be performed in accordance with procedures outlined in Section 3.0 of the "Observers' Manual - Dobson Ozone Spectrophotometer (Limited Program of Observations)." Whenever difficulty is experienced with either the calibration or performance of the spectrophotometer, every effort should be made to ascertain whether or not the spectral characteristics of the instrument, or the testing apparatus, is the cause. The suggested steps outlined in the Observers Manual should be followed in locating the source of difficulty and correcting it. Under no circumstances should the optics of the spectrophotometer be tampered with, or major re-calibrations undertaken, without prior approval of the Project Leader, Atmospheric Ozone Research Project.

Every precaution should be taken that before removing the lids or cover of the spectrophotometer and placing ones hands inside the instrument the Super H.T. power supply is switched off. This is necessary to avoid damage to the instrument photomultiplier tube as well as a safety measure.

Calibration tests should be entered on WB Form 465-3 and submitted in accordance with existing instructions. Entries should also be made on Form 450-10, Electronic Maintenance Log, each time malfunctioning occurs, repairs are made, or periodic checks are performed.

It is expected that a technician from the Central Office will visit each ozone station at intervals of about a year to conduct special spectrophotometer tests,

7-15-63

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

July 3, 1963

Instrumental Engineering-Division 0-3.4

MAINTENANCE SCHEDULE FOR DOBSON OZONE SPECTROPHOTOMETER

DAILY

What to Check	How to Check	Precautions & Remarks
1. Station Log	Take corrective action on reported malfunctions.	
2. Timer Clock	Check against known standard (e.g., WWV radio signal) for accuracy. (Time check should be made each morning before Observations are commenced.)	

WEEKLY

Note : If the photomultiplier is exposed to strong light it6 spectral characteristics will be temporarily altered and slightly erroneous instrument dial reading6 may result. It is, therefore, necessary to darken the shelter as much as is convenient before opening the instrument. Also, be sure to turn off the Super H.T. voltage supply unit before opening the instrument in order not to damage the photo-multiplier.

1.	Q1 and Q2 Levers and Stops, and Recording Dial	Check for freedom of movement, binding, or erratic movement. If sticking of recording dial occurs, use an air squirt to blow the metal dust off the optical Wedge tracks. DO NOT GREASE THE OPTICAL WEDGE TRACKS.	Do not disassemble the Q levers. Do not bring the Q levers or recording dial hard against the mechanical stops.
2.	S4 Shutter Rod and Wavelength Selector Rod	Check for freedom of movement of rods in and out of instrument. If sticking occurs, remove the metal plate and rubber gasket through which the rods are inserted into the instrument, and lubricate each rod with a drop or two of light oil.	Do not use an excessive amount of oil.

MAINTENANCE SCHEDULE FOR DOBSON OZONE SPECTROPHOTOMETER

WEEKLY- Continued

What to Check	How to Check	Precautions & Remarks
7. Desiccant	Remove the test cylinder at left end of spectrophotometer and check the color of silica gel, which should *be* blue. If the silica gel is pink, the drying vessels should be m-charged.	Old model spectrophotometers do not possess silica gel test cylinders. Inspection should, therefore, be performed by removing one of the cover plates located on top of the instrument.
8. Sun Director	Examine for cleanliness. Remove any dust that has accumulated on the quartz optics with an air squirt, camel's hair brush, or lens tissue moistened with clean alcohol	Do not touch optical surfaces with fingers as oily residue may be left on them.
9. Ground Quartz Plate	Wash ground quartz plate with soap and water if necessary. Rinse well, and dry with a lint-free cloth or tissue paper	Avoid touching quartz plate with fingers.

MONTHLY

Note: 1. Exercise caution as all voltages must be on for conducting instrument calibrations.

2. Check thermometer to ensure that instrument is at temperature equilibrium when tests are conducted.

3. Routine spectrophotometer tests should be conducted near the 28th day of each month, or more frequently, as directed from Central Office,

1. Mercury Lamp Test	Perform test in accordance with instructions given in Section 3.6.1 of the Observers' Manual.	

MAINTENANCE SCHEDULE FOR DOBSON OZONE SPECTROPHOTOMETER

MONTHLY - Continued

What to Check	How to Check	Precautions & Remarks
6. Shelter - Contd.	for deterioration of components. Clean and lubricate components as required. Advise the MIC if painting or other work is necessary. Replace burnt out light bulbs. During cold-weather check operation of gas or electric heater, and gas supply.	

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

Instrumental Engineering Division

August 15, 1963

INSTRUCTIONS FOR INSTALLING AND OPERATING U. S. WEATHER BUREAU PHOTOELECTRIC SUNSHINE SWITCH IN CONJUNCTION WITH SUNSHINE AND PRECIPITATION INDICATOR (MAGNETIC AMPLIFIER TYPE)

These instructions are applicable only to the photoelectric sunshine switch when operated in conjunction with the magnetic amplifier type sunshine and precipitation totalizing indicator (A232)

MOUNTING AND ALIGNING

A condulet floor flange is furnished as the mounting base for the sunshine switch. Where it is possible to install the new switch on a pipe support, the wires can be concealed, Waving selected the mounting location, proceed as follows:

a. Screw base down securely

b. Rotate long axis of switch into a north-south position with the drain hole to the bottom (see accompany lithograph) and tighten switch to base by means of the set screws on the support collar.

c. Loosen the vertical-angle adjustment friction-joint and tilt switch until its axis makes an angle with the horizontal equal to the latitude of the station. (For instance, at Washington, the angle of elevation would be 38° 55'.) Clamp securely.

A convenient method of adjusting to the proper angles of elevation is to use a bubble projector from a combination square. This adjustment should be made with considerable care and once the switch is properly set it should not be changed.

WIRING

Three (3) wires are necessary to connect the sunshine switch to the totalizing indicator assembly. Since these wires carry only a few microamperes, the size of the conductors is not critical, however, they must be well insulated. From the standpoint of uniformity, a three-conductor unshielded cable employing #14 wire is desirable. The wires from the sunshine switch are coded red, white, and blue. They are connected to terminals, 1, 2, and

3 (red, white, and blue in that order) on the terminal strip located on the back of the indicator assembly. The white wire is the common positive of both photocells. The red connects to the negative of the bottom cell and the blue connects the negative of the top cell.

SHADE RING ADJUSTMENT

The purpose of the shade ring is to prevent the sun from shining directly on the top photocell at any time. To accomplish this, the ring must be shifted up or down periodically as the sun moves north or south with the seasons. It will be noted that there are three circular grooves located along the shade ring support rods. The top groove locates the position of the ring for the summer period, the bottom one the winter, and the middle position for the spring and fall. The shade ring can be shifted from one groove to another by grasping the ring with both hands, one on either side near the points of support, and shoving in the direction required. When changing the position of the ring, move it until the detents again drop into place, The following is the shade ring setting schedule far any latitude in the northern hemisphere:

Change to upper position April 13

Change to middle position August 30

Change to lower position October 11

Change to middle position February 28

This schedule must be followed rigidly. If the shade ring is changed before the proper date or after the proper date, the direct rays of the sun will fall on a portion of the upper cell which will cause a loss of sensitivity. Loss of sensitivity for the same reason may also occur if the switch is improperly aligned. It cannot be over-emphasized that the switch will not operate if any direct sunlight strikes the sensitive portion of the opal glass on the top of the switch. The sensitive portions, top and bottom, extend about one inch from each end of the opal tube.

SENSITIVITY ADJUSTMENTS

The white pilot light L1 associated with the sunshine switch circuit is located to the left of the center near the top of the indicator. The counter located under this light indicates the total elapsed time (in minutes) of sunshine. The slotted shaft is for adjustment of the sensitivity. The sensitivity adjustment should be made on a clear day, about noon, when the general diffused sky light is as bright as possible. Two persons are needed to make the adjustments; one out-of-doors at the switch, and one inside at the indicator.

The procedure consists of shading the sunshine switch from direct sunlight and at the same time adjusting the potentiometer Rl on the indicator until. the lamp L1 just lights. It is important that this adjustment be made when the sky is bright. If done in cloudy weather it may not be in balance in bright weather; but if balanced in bright weather it should be in balance in cloudy weather. The shade used should be two or three feet across and should be held at a distance of at least two or three feet above the top of the switch while making the adjustments. Care should be exercised to see that the complete switch is in the shadow, preferably at the center of the shadow. The person holding the shade should stand to the north or south of the switch and as far away as possible. Such procedure will insure that a minimum of sky light will be cut off by the person supporting the shade.

Adjustments are made as follows:

1. With the shade in place, rotate the potentiometer to full clockwise position (looking at front of indicator)

2. Rotate potentiometer very slowly counterclockwise until the light comes on

3. The potentiometer is now slightly too far counterclockwise and must be turned clockwise by a very small amount

An alternate method consists of making the sensitivity adjustment during the time the sun is shaded by a small cumulus cloud. The cloud should completely cover the sun and be large enough that no bright edge is in evidence. As in the first method, the adjustments should be made during the middle of the day when the general light level is high.

As a rule, when the proper adjustment is made, the potentiometer should not again be disturbed; however, it has been found that in some locations it is necessary to readjust the sensitivity setting after the seasonal. adjustments of the shade ring are made. When adjustments are complete, the shaft lock should be tightened to prevent tempering with the setting.

MAGNETIC AMPLIFIER INDICATOR

THEORY OF OPERATION

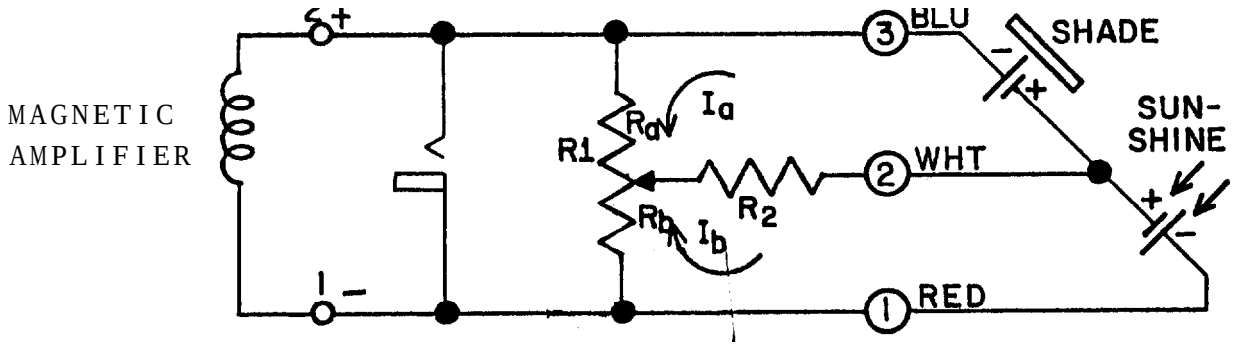
Refer to Drawings 451.4167/D, revised June 20, 1963, 451.4167/E, dated June 21, 1963, and 451.4167/F, dated June 21, 1963.

The magnetic amplifier indicator will operate the modified Esterline-Angus 20-pen recorder or other recording equipment compatible with this system. The associated circuitry converts signals from meteorological sensors to continuous records and digital displays. This 20-pen recorder has been modified to indicate wind direction, wind speed, sunshine, and precipitation; others may be added. There are two types of these recorders used; one having the stepping switch mounted on the back of the recorder, and the other mounted inside the recorder. The wind direction coils on the recorder with the external stepping switch have their common terminals brought out to terminal No. 20 (WC) as shown on Drawing 451.4167/F so as to be energized once a minute for two seconds. On the recorder with internal stepping switch, this common goes to a new terminal WC also shown on Drawing No. 451.4167/F. The remaining coils have their common side brought to the common terminal marked RC on the recorder. The stepping stitch is connected to pens 15 through 19, and so arranged that for each tipping bucket movement, the pens mark a record similar to that of the triple register precipitation record, i.e., pens, 15, 16, 17, 18, 19, 19, 18, 17, 16, and 15, will mark in that sequence for 10 tips.

The voltage necessary to operate the coils on the Esterline-Angus operational recorder is furnished by the 6-volt DC supply in the indicator.

The photoelectric sunshine switch system operates because of the difference in the amount of light falling on two photocells, both of which are exposed to skylight while one is shaded from direct sunlight. They are so connected and adjusted by potentiometer R1 that the energy due to skylight cancels; only that which is due to sunlight is available to operate the coil circuitry- The two cells are selected to have nearly equal outputs (within 20% of each other) before assembly in the exposure unit.

OPERATION OF SUNSHINE CIRCUIT



ADJUSTMENT NOTES: With cells shaded from direct sunlight; potentiometer R1. Is adjusted so that minimum current flows across the magnetic amplifier terminals 1 and 2 during skylight conditions: IaRa ≈ IbRb.

When sunlight falls on the unshaded cell, its output increases, therefore, IbRb is greater than IaRa. Since a difference in potential then exists between the two ends of the potentiometer R1, current flows through the magnetic amplifier windings (terminals 1 and 2) actuating the sunshine circuit by closing relay K1.

The polarities are such that since Ib becomes more negative than Ia during sunshine, the red lead is said to be negative and the blue positive. Polarities are indicated on schematics where useful.

POWER SUPPLY

The power supply integral with the panel, supplies both 6 and 12 volts to operate a modified Esterline-Angus Recorder or other recording equipment compatible with this system. This power supply has a full-wave bridge across a center-tapped 12 volt transformer winding. As a full wave bridge it furnishes 12 VDC at panel terminals 6 and 11: As a full wave rectifier (CR1, CR2) against the center tap, it furnishes 6V with fused (F3) negative common to both supplies. Cl and C2 filter the 12 and 6 volt outputs, respectively. Power supply output is 5 amperes. This may be drawn from either 6 or 12 volts. If both supplies are used at the same time, 5 amperes total current is the maximum allowable. (Fuse F3 is 3AG 5A)

INTERRUPTER

The interrupter SW1 connects the 12V supply to Relays K2 and K3 for 2 seconds of every minute. This short closure, of K2 and K3 contacts, provides a timing pulse for external equipment (wind direction in the recorder) or other requirements. At the same time it "samples" the sunshine circuit; if operating, then the Sunshine Counter records minutes of sunshine.

MAGNETIC AMPLIFIER

The magnetic amplifier A1 converts the small signal voltage (about 5.5 millivolts at J1) developed across R1 from the sunshine sensor to sufficient voltage (about 12 volts) to operate relay K1. Increase in signal voltage to 40 millivolts does not increase the output to more than 15 volts.

RELAYS

The function of relays K1-K4 is the operation of various panel counters and recorder pens. Operating characteristics are; 3 milliamperes at 12 volts -- vertical. position, pins down. Luring a condition of sunshine, relay K1 is actuated by the magnetic amplifier Al which operates the circuit for indicator lamp L1; at the same time K1 closes part of the external circuit for SS recorder and SS counter. Relays K2 and K3 close once each minute for 2

seconds completing the circuit between terminals 4 and 6 for external recorder. In addition, the sunshine counter is energized for a count. K4 is energized when the remote tipping bucket closes the return circuit to the 12V power supply. In turn K4 closes the circuit for the precipitation counter end external recorder (terminal #9).

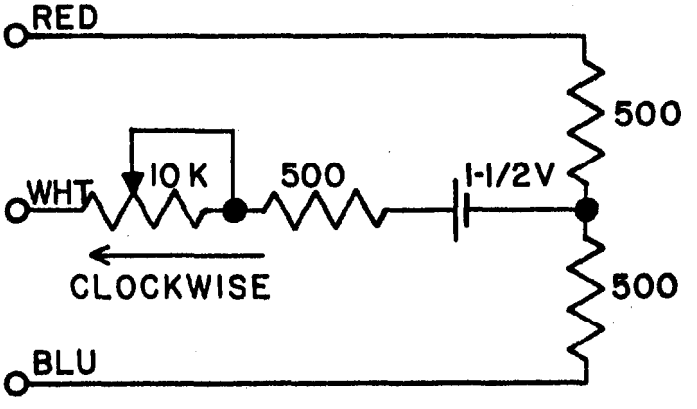
COUNTERS

Identical counters for sunshine and precipitation are impulse operated from the 6V power supply through the relay circuitry. Actual operating conditions, are about 8 volts at 500 milliamperes.

DIODES

Diodes CR5, CR6, CR7, and CR8 are spark suppressors which are installed to extend the life of contacts in SW1, K1, K2, K3, and K4.

SIMULATOR (TEST RIG)



NOTES ON SERVICING THE MAGNETIC AMPLIFIER TOTALIZING INDICATOR

TEST

Sunshine Switch: Disconnect sunshine leads from the indicator. Measure current from white to blue and white to red with meter set on the 100 microamperes range. Under bright skylight (no direct sunlight) normal readings should be in order of 20 to 100 microamperes. The two reading should agree within 20%.

Indicator Tests Conditions - Sunshine switch connected, shade ring in proper setting, line cord connected, sun shining, R1 set near middle range, The terminals referred to in the indicator tests are the terminal strip positions located on the rear of the indicator.

1. Red indicator lamp. If lamp fails to light, then check:

A - Line voltage	115VAC
B - Fuses in line plug	F1 and F2
C - Neon lamp	L2

2. 12 V DC power supply, connect multimeter and 4 ohm 50 watt resistor across terminals 6, negative, and 11, positive. If at least 12 volts are not indicated, then check:

A - Fuse	F3
B - Capacitor	C1
C - Rectifier	CR1, CR2, CR3 and CR4
D - AC voltage across bridge rectifier	12V

3. 6 V DC power supply, connect multimeter and 2 ohm 50 watt resistor across terminals 6, negative and 8, positive. If at least 6 volts are not indicated, then check:

A - Fuse	F3
B - Capacitor	C2
C - Rectifier	CR1 and CR2
D - AC voltage across bridge rectifier	12V

4. Interrupter motor: If not running, then check at motor lead tie points for 110 V AC. If voltage is indicated, replace

5. Interrupter switch: Remove relay K3 and insert multimeter leads into relay socket at pins 7 and 8. With motor running, 12 volts will be indicated for 2 seconds, and no voltage for fifty-eight seconds. If no voltage is indicated, then check:

A - Wiring

B- Interrupter switch

6. Magnetic amplifier, relay K1, and white indicator lamp L1: Connect sunshine simulator (test rig) leads to terminal strip, red to 1, white to 2, and blue to 3, rotate knob on simulator (test rig) to full clockwise position, rotate potentiometer R1 on Indicator clockwise until white lamp lights. If lamp fails to light, then check:

   A - Light L1

   B - Relay (substitute) K1

   C - Magnetic amplifier A1

   D - Polarity of sunshine switch, negative on terminal 1, positive on terminal 3.

7. Relays K2 and K3: With white lamp glowing, the sunshine counter should advance every 60 seconds. Relays will be closed 2 seconds of every minute. Test by ohmmeter between terminals 5 and 6 for K2 and between terminals 7 and 8 for K3.

8. Relay K4: Precipitation counter should advance by touching a jumper between terminals 6 and 10, if not, replace relay K4.

   NOTE: THE MERCURY RELAYS WILL NOT OPERATE IN A HORIZONTAL OR INVERTED POSITION. ALWAYS OPERATE VERTICALLY WITH PINS DOWN.

9. Contacts on relays:

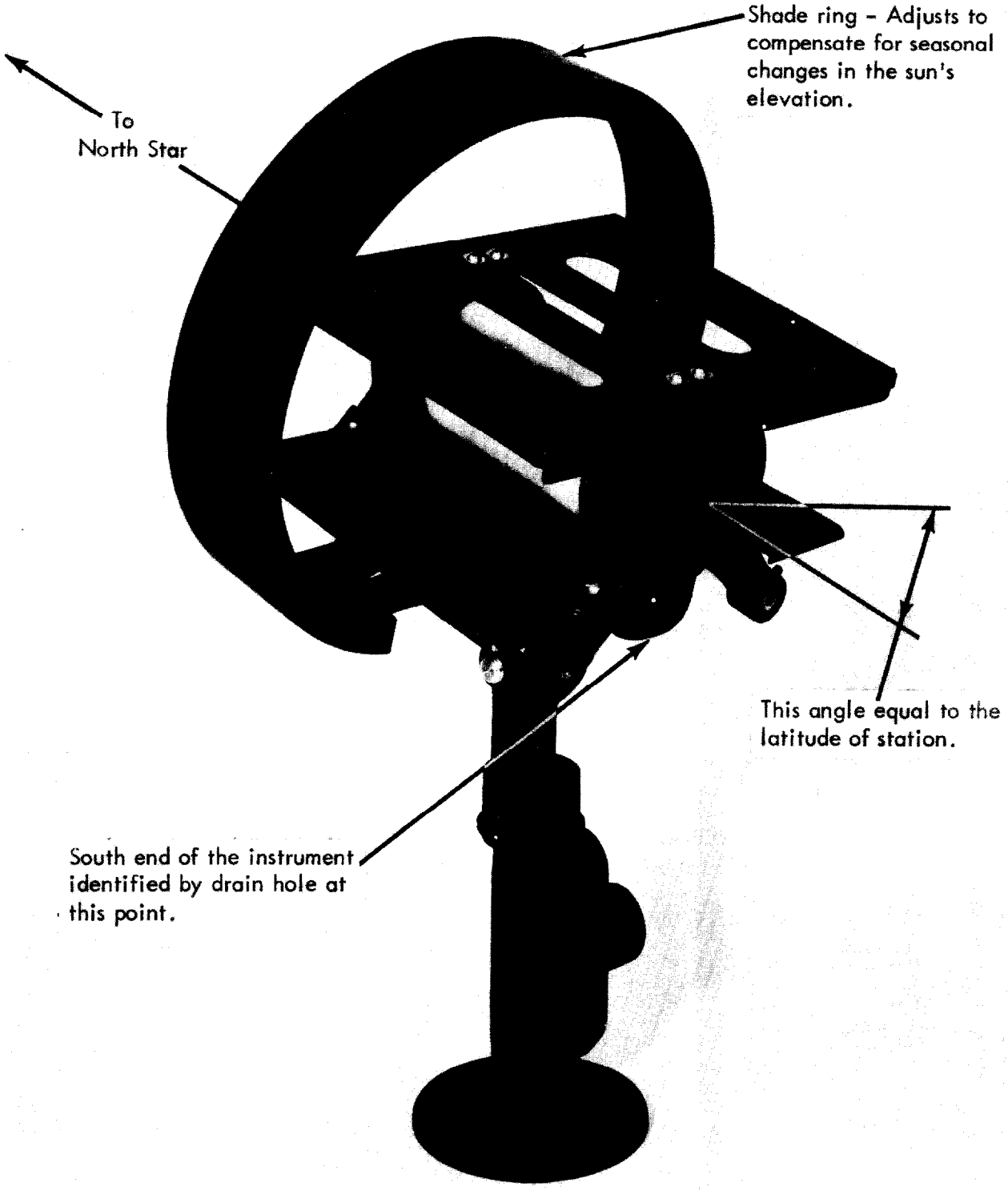
   A -K1- Connect ohmmeter between terminals 4 and 6, meter should indicate continuity each time sunshine counter M1 advances.

   B - K2- Connect ohmmeter between terminals 5 and 6, meter should indicate each time sunshine counter M1 advances.

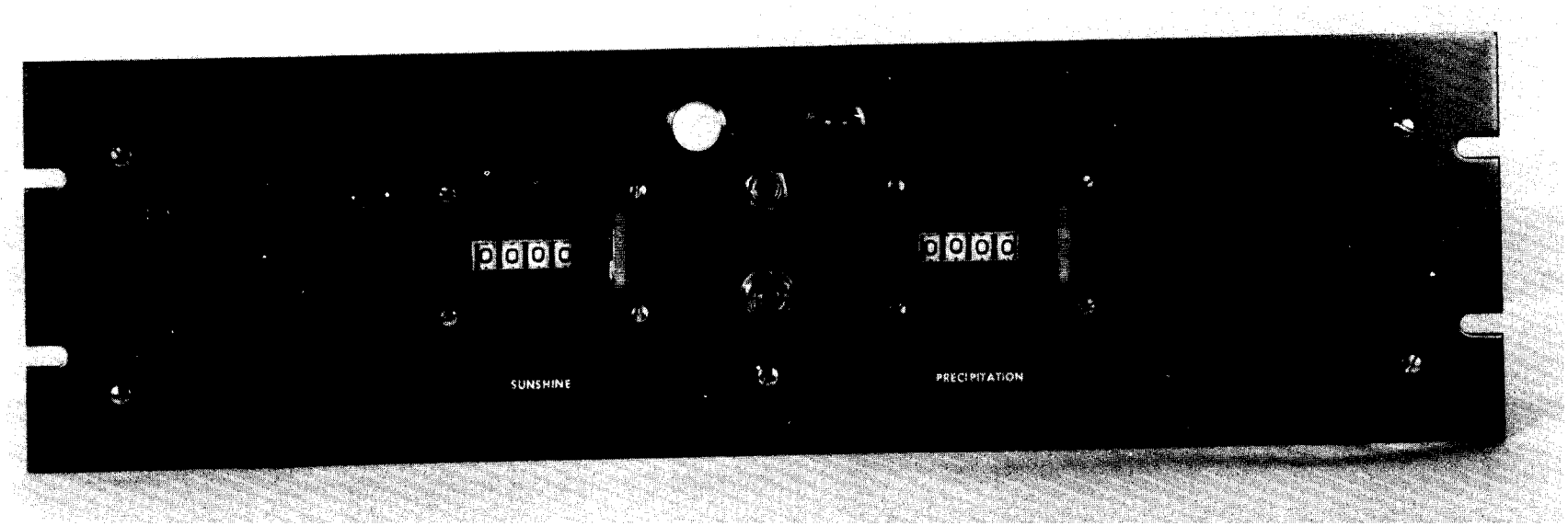
   C - K3 - Connect ohmmeter between terminals 7 and 8, meter should indicate each time sunshine counter Ml advances.

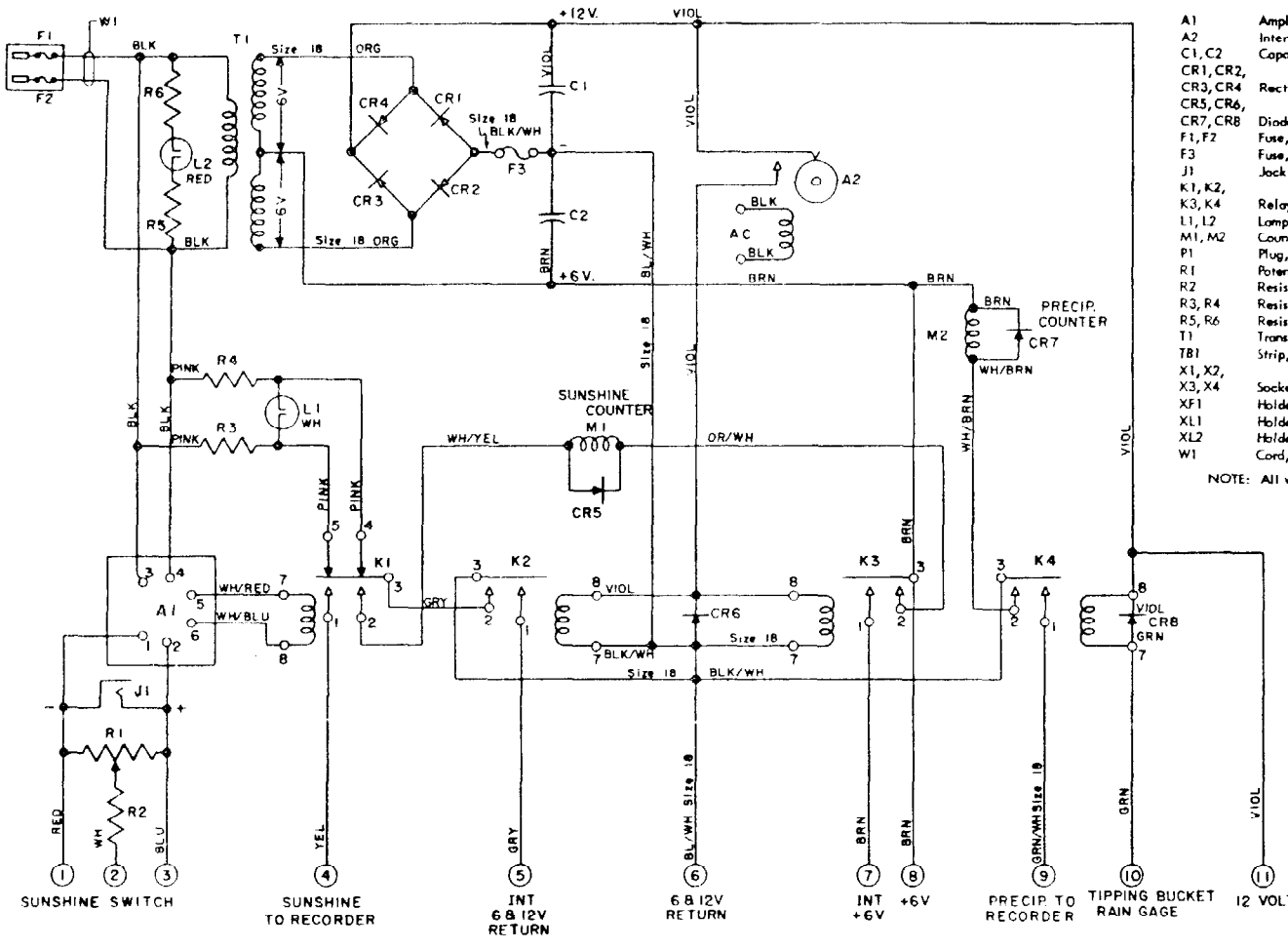
   D - K4 - Connect ohmmeter between terminals 6 and 9, Meter should indicate each time terminals 6 and 10 are connected. This operates precip counter M2.

PHOTOELECTRIC SUNSHINE SWITCH



SUNSHINE AND PRECIPITATION INDICATOR
MAGNETIC AMPLIFIER TYPE)





PARTS LIST

A1	Amplifier, magnetic; Siegler Corp. Model MA-60158-1
A2	Interrupter, motor driven, 1 rpm; Assy Prod. 2059-1
C1, C2	Capacitor, 6000 mf, 15 vdc; Mallory HC-1560A
CR1, CR2, CR3, CR4	Rectifier, 1N1341A
CR5, CR6, CR7, CR8	Diode, 1N2069
F1, F2	Fuse, 1-amp, normal; Buss AGC
F3	Fuse, 5-amp, normal; Buss MTH
J1	Jack, test, open circuit, 2-cond.
K1, K2, K3, K4	Relay; Western Electric 276B
L1, L2	Lamp; NE 51
M1, M2	Counter, 24 v 60 cyc AC, 6 w; Veeder Root R150704
P1	Plug, fused; Elmenco
R1	Potentiometer, 50-ohm, ww, 2-watt
R2	Resistor, 75-ohm, ww, 5-watt
R3, R4	Resistor, 15K-ohm, carbon, 1/2-watt
R5, R6	Resistor, 68K-ohm, carbon, 1/2-watt
T1	Transformer, filament, 115 v, 6.3+6.3 vct; UTC S-70
TB1	Strip, terminal; Cinch Jones 11-141-Y
X1, X2, X3, X4	Socket, relay, octal base
XF1	Holder, fuse; for F3
XL1	Holder, lamp, white; Dialco 531310-995
XL2	Holder, lamp, red; Dialco 531310-991
W1	Cord, line, 6-ft; Beldon 8478

NOTE: All wires Size 20 except as shown

6-20-63
4-26-62
Revised 2-15-62

U.S. DEPT OF COMMERCE — WASHINGTON 25, D.C.

WEATHER BUREAU

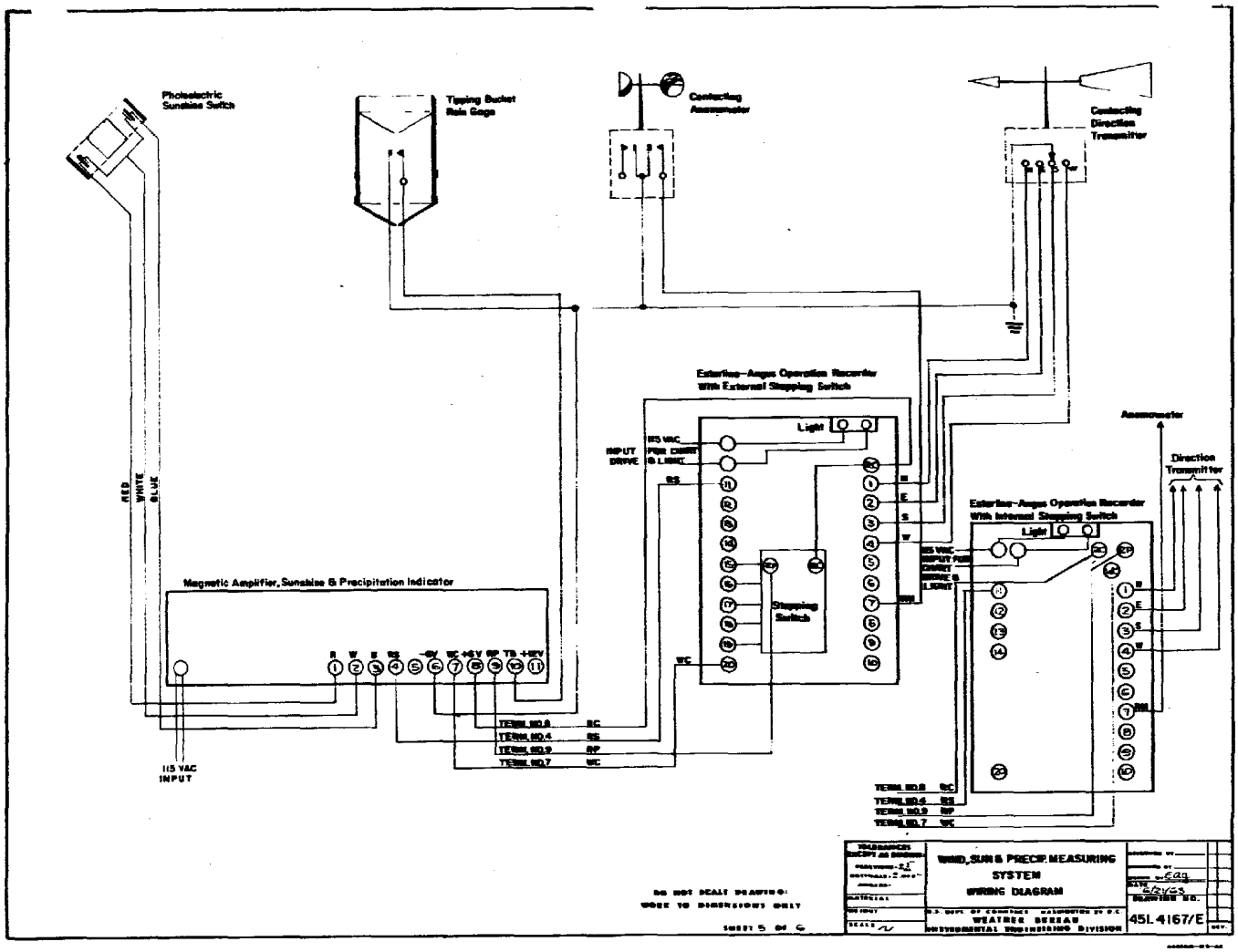
INSTRUMENTAL ENGINEERING DIVISION

INDICATOR, SUNSHINE & PRECIPITATION TOTALIZING, MAGNETIC AMPLIFIER TYPE

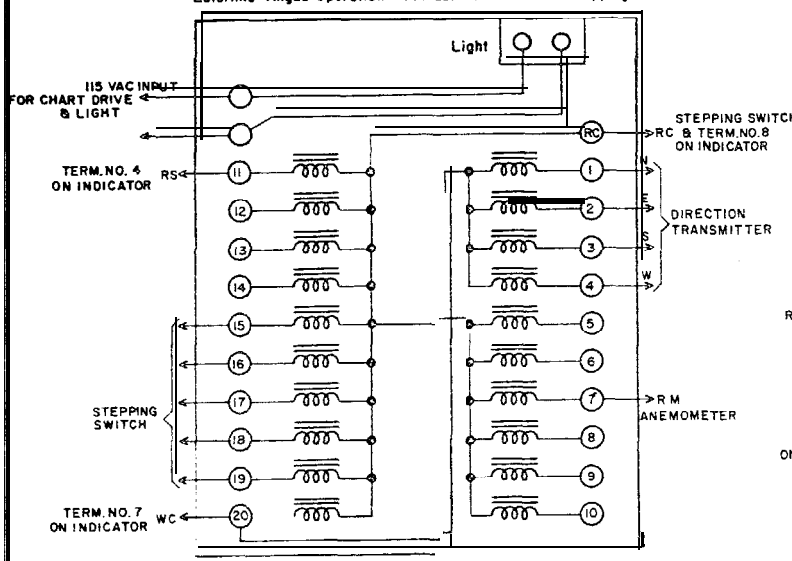
P/O WIND, SUN & PRECIP. MEASURING SYSTEM

APPROVED BY
DRAWN BY W. V. Compton
SCALE

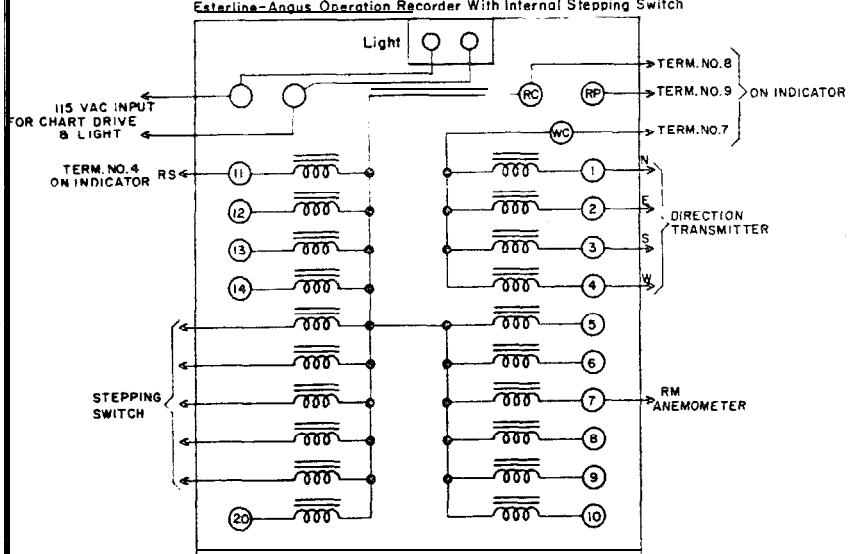
DRAWING NO 451.4167/D
DATE 8-8-61


Photoelectric Sunshine Switch
Tipping Bucket Rain Gage
Contacting Anemometer
Contacting Direction Transmitter
Exterior-Anger Operation Recorder With External Stepping Switch
Exterior-Anger Operation Recorder With Internal Stepping Switch
Magnetic Amplifier, Sunshine & Precipitation Indicator
Stepping Switch
Light
Anemometer
Direction Transmitter
RED
WHITE
BLUE
115 VAC INPUT
INPUT DRIVE
WIND, SUN & PRECIP. MEASURING SYSTEM
WIRING DIAGRAM
45L 4167/E
DO NOT SCALE DRAWING
WORK TO DIMENSIONS ONLY

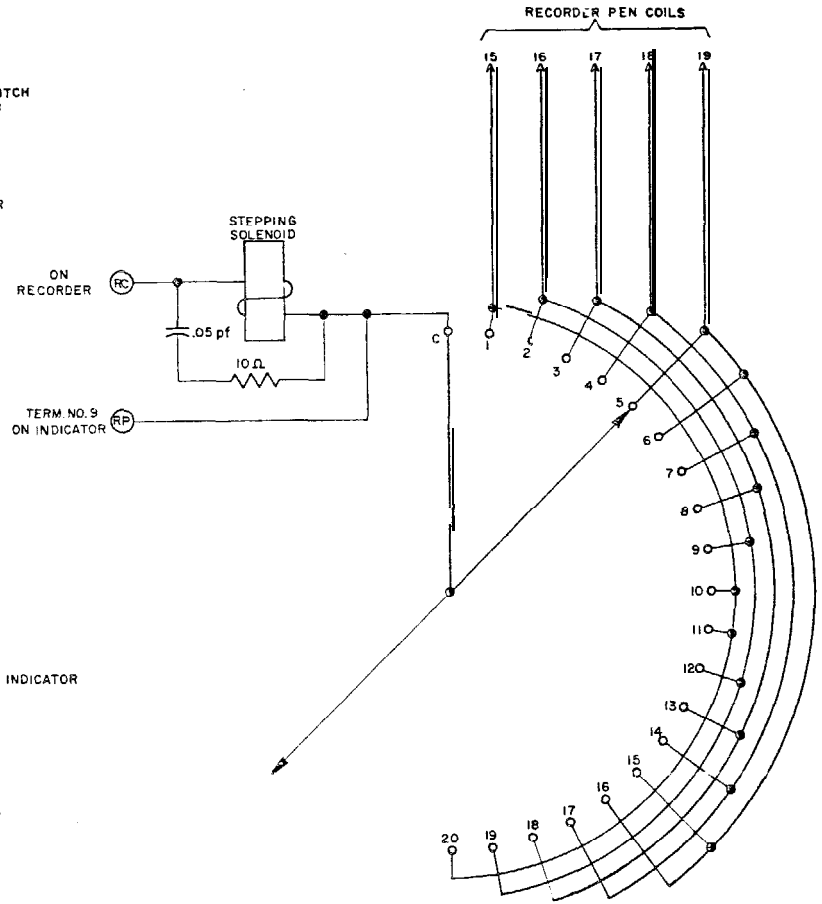
Esterline-Angus Operation Recorder With External Stepping Switch



Esterline-Angus Operation Recorder With Internal Stepping Switch



Recorder Stepping Switch



DO NOT SCALE DRAWING: WORK TO DIMENSIONS ONLY

SHEET 6 OF 6

TOLERANCES EXCEPT AS SHOWN: FRACTIONS ±1/64 DECIMALS .X ±.03 .XX ±.01 ANGLES ±1°	RECORDER WIRING DIAGRAM FOR USE WITH MAGNETIC AMPLIFIER INDICATOR P/O WIND, SUN & PRECIP. MEASURING SYSTEM	APPROVED BY
MATERIAL		EXAMINED BY
WEIGHT	U.S. DEPT. OF COMMERCE WASHINGTON 25 D.C. WEATHER BUREAU INSTRUMENTAL ENGINEERING DIVISION	DRAWN BY E.A.G. DATE 6/21/53 DRAWING NO. 451.4167/F
SCALE		REV

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

June 9, 1959

IN REPLY, PLEASE ADDRESS
CHIEF, U. S. WEATHER BUREAU
WASHINGTON 25, D. C.
AND REFER TO

0-3.4

FILE: 456 MEMO (Maintenance of Photoelectric Sunshine Switch and Associated Indicating Panels) WASHINGTON, D. C. 6-9-59

MEMORANDUM:

TO : All Electronic Technicians

FROM : Chief, Instrumental Engineering Division

SUBJECT: Maintenance of Photoelectric Sunshine Switch and Associated Indicating Panels

The electronic technicians who have not done so in the past, will assume the responsibility for the maintenance of the photoelectric sunshine switch and the various indicating panels which may be connected to it, including the electrical circuitry of the associated equipment.

The SES or the traveling ELTEC, while at his headquarters station, should make daily checks to determine that the equipment is "operational". The traveling ELTEC at other than his headquarters station is expected to perform preventive maintenance to assure continuous operation of the equipment. Regular preventive maintenance should be performed on a quarterly basis, as indicated below, where applicable:

1. Remove from rack and clean the dust from the exposed parts. This should be done by using a blower.

2. Check the output of the photocells to see that they are balanced within the limits specified.

3. Check the voltage output of the low voltage power supply, in accordance with instructions.

4. Check the voltage output of the high voltage power supply, in accordance with instructions.

5. Replace in rack.

6. Determine whether equipment is operational.

following instructions and diagrams are being supplied since a manual is not available for this equipment.

Instructions for installing and Operating U.S. Weather Bureau Photoelectric Sunshine Switch, revised Aug. 30, 1957

Picture of Sunshine Switch

Picture of Totalizing Panel

Panel, Control, Photoelectric Sunshine Switch, Drawing No. 044.1422/A, dated Feb. 16, 1956

Schematic Diagram of Triple Register With Photoelectric Sunshine Switch and Panel, Drawing No. 451.4166/A, dated Sept. 24, 1956

Meteorograph System. Wind, Sun, and Precipitation, With Totalizing Indicator; Esterline-Angus Operational Recorder Type, Weather Bureau Design, Drawing No. 451.4164/A, dated Apr. 6, 1956

Circuitry of Totalizing Indicator for Wind, Sun and Precipitation; Esterline-Angus Recorder Type Meteorograph System, Drawing No. 451.4164/C, dated Apr. 6, 1956

Circuitry of Modified Esterline-Angus Operational Recorder for Wind, Sun, and Precipitation Meteorograph System, Drawing No. 451.4164/B, dated Apr. 6, 1956

Notes on Servicing Various Totalizing Panels

It is not planned to have this information assembled into a manual; however we believe the information contained in the attached instructions and schematics will provide valuable assistance wherever you encounter trouble with the sunshine switch. The instructions should be incorporated as part of your instrumental maintenance manual.

Wm. R. Thickstun

Attachments

cc:RAOs

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington 25, D.C.

Instrumental Engineering Division

Revised August 30, 1957

INSTRUCTIONS FOR INSTALLING AND OPERATING U.S. WEATHER BUREAU PHOTOELECTRIC SUNSHINE SWITCH

These instructions are applicable only to the photoelectric sunshine switch when operated in conjunction with photoelectric sunshine switch control. panels bearing serial numbers from 1-56 to 100-56.

MOUNTING AND ALIGNING

A condulet floor flange is furnished as the mounting base for the sunshine switch. Where it is possible to install the new switch on a pipe support, the wires can be concealed. Having selected the mounting location, proceed as follows:

a. Screw base down securely.

b. Rotate long axis of switch into a north-south position with the drain hole to the bottom (see accompanying lithograph) and tighten switch to base by means of the set screws on the support collar.

c. Loosen the vertical-angle adjustment friction-joint and tilt switch until its axis makes an angle with the horizontal equal to the latitude of the station. (For instance at Washington, the angle of elevation would be 38° 55'.) Clamp securely.

A convenient method of adjusting to the proper angles of elevation is to use a bubble protractor from a combination square. This adjustment should be made with considerable care and once the switch is properly set it should not be changed.

WIRING

Three (3) wires are necessary to connect the sunshine switch to the totalizing indicator panel assembly. Since these wires carry only a few microamperes, the size of the conductors is not critical, however, they must be well insulated, From the standpoint of uniformity, a three-conductor unshielded cable employing #14 wire is desirable. The wires from the sunshine switch ore coded red, white, and blue, They are connected to the terminal strip located beneath the potentiometer on the back of the panel assembly. The terminal strip is painted red, white, and blue, to corre-

pond to the color coding of the wires from the sunshine switch. The white wire is the common positive of both photocells. The red connects to the negative of the bottom cell and the blue connects the negative of the top cell.

SHADE RING ADJUSTMENT

The purpose of the shade ring is to prevent the sun from shining directly on the top photocell at any time. To accomplish this, the ring must be shifted up or down periodically as the sun moves north or south with the seasons. It will be noted that there are three circular grooves located along the shade ring support rods. The top groove locates the position of the ring for the summer period, the bottom one the winter, and the middle position for the spring and fall. The shade ring can be shifted from one groove to another by grasping the ring with both hands, one on either side near the points of support, and shoving in the direction required. When changing the position of the ring, move it until the detents again drop into place. The following is the shade ring setting schedule for any latitude in the northern hemisphere:

Change to upper position April 13th
Change to middle position August 30th
Change to lower position October llth
Change to middle position February 28th

This schedule must be followed rigidly. If the shade ring is changed before the proper date or after the proper date, the direct rays of the sun will fall on a portion of the upper cell which will cause a loss of sensitivity. Loss of sensitivity for the same reason may also occur if the switch is improperly aligned. It cannot be over-emphasized that the switch will not operate if any direct sunlight strikes the sensitive portion of the opal glass on the top of the switch, The sensitive portions, top and bottom, extend about one inch from each end of the opal tube.

SENSITIVITY ADJUSTMENTS

The pilot light located near the top-center of the indicator panel is associated With the sunshine switch circuit. The counter directly under the pilot light reads the total elapsed time in minutes the sun has shown and the snap-in metal plug to the right of the counter conceals the slotted shaft for adjustment of the sensitivity. This plug must be removed and a screwdriver used to turn the shaft in order to make the sensitivity adjustment. The sensitivity adjustment should be made on a clear day, in the middle of the day, at a time when the general diffused sky light is as bright as is possible to get. Two persons are needed to make the adjustments; one out-of-doors at the switch, and one Inside at the panel,

The procedure consists of shading the sunshine switch from direct sunlight and at the same time adjusting the potentiometer on the panel until the sensitive relay is just on the verge of tripping on. It is important that

this adjustment be made when the sky is bright. If done in cloudy weather it may not be in balance in bright weather; but if balanced in bright weather it always will be in balance in cloudy weather.

The shade used should be two or three feet across and should be held at a distance of at least two or three feet above the top of the switch while making the adjustments. Care should be exercised to see that the complete switch is in the shadow, preferably at the Center of the shadow, The person holding the shade should stand to the north *or* south of the switch and as far away as possib1e. Such procedure will insure that a minimum of sky light will be cut off by the body of the person supporting the shade.

Adjustments are made as follows:

1. With the shade in place, rotate the potentiometer clockwise (looking at front of panel) as far as it will go.

2. If the pilot light is burning, press the test switch (lower left side of panel) and hold down until the light goes off (3 or 4 seconds), then release the switch.

3. Rotate potentiometer very slowly counterclockwise until the light comes On.

4. The potentiometer is now slightly too far counterclockwise and must be returned by a very small amount.

5. Turn potentiometer clockwise by an increment equal to about 1/32 inch (half the thickness of a dime).

6. Press test switch and hold down several seconds, then release. If the light comes on, rotate potentiometer clockwise another small increment. Repeat this process until the lamp does not light up when the switch is released. This should be the correct setting of the potentiometer. Repeat the whole procedure two or three time6 to be sure the exact setting has been determined.

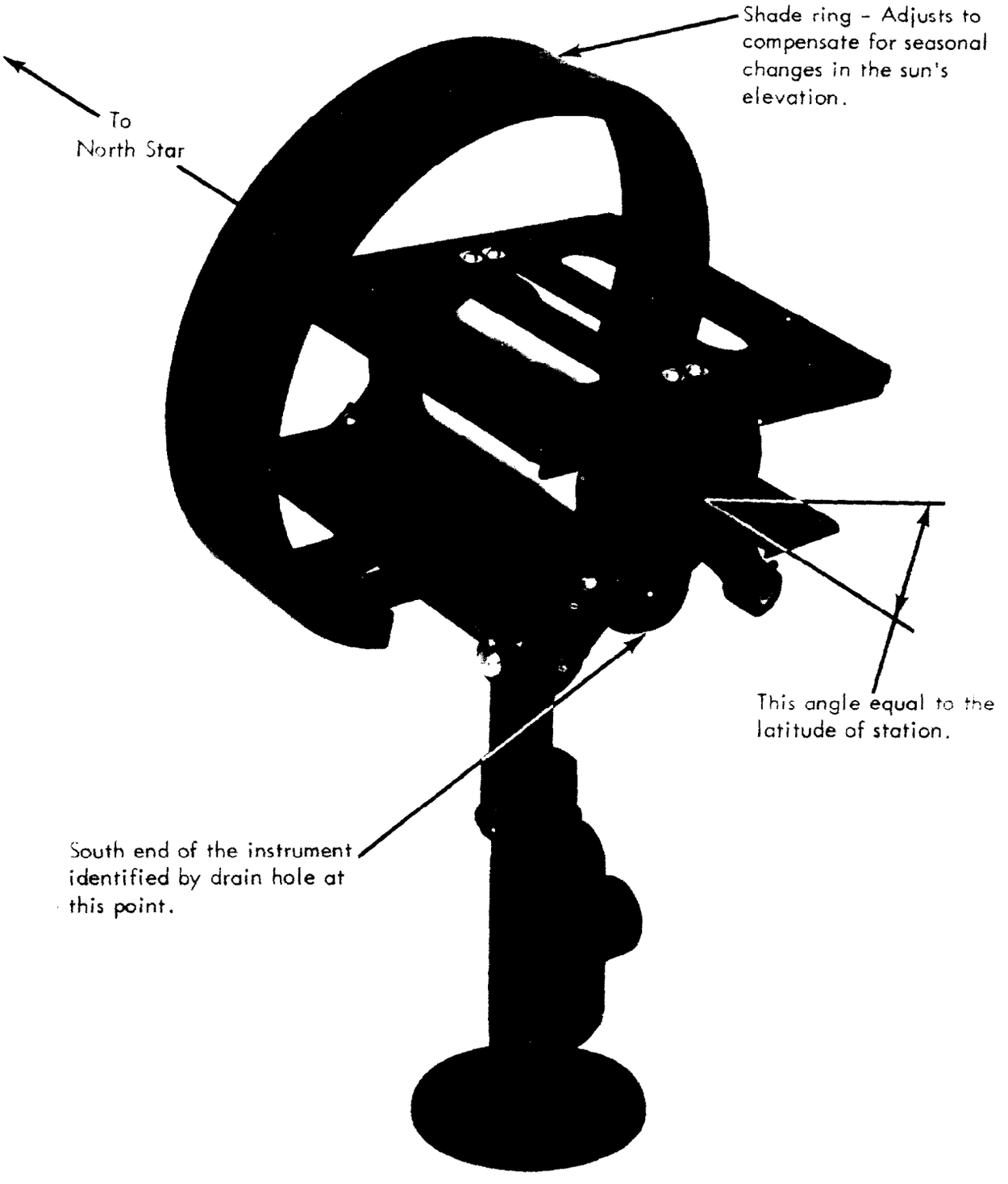
An alternate method consists of making the sensitivity adjustment during the time the sun is shaded by a small cumulus cloud. The cloud should completely cover the sun and be large enough that no bright edge is in evidence. As in the first method, the adjustments should be made during the middle of the day when the general light level is high,

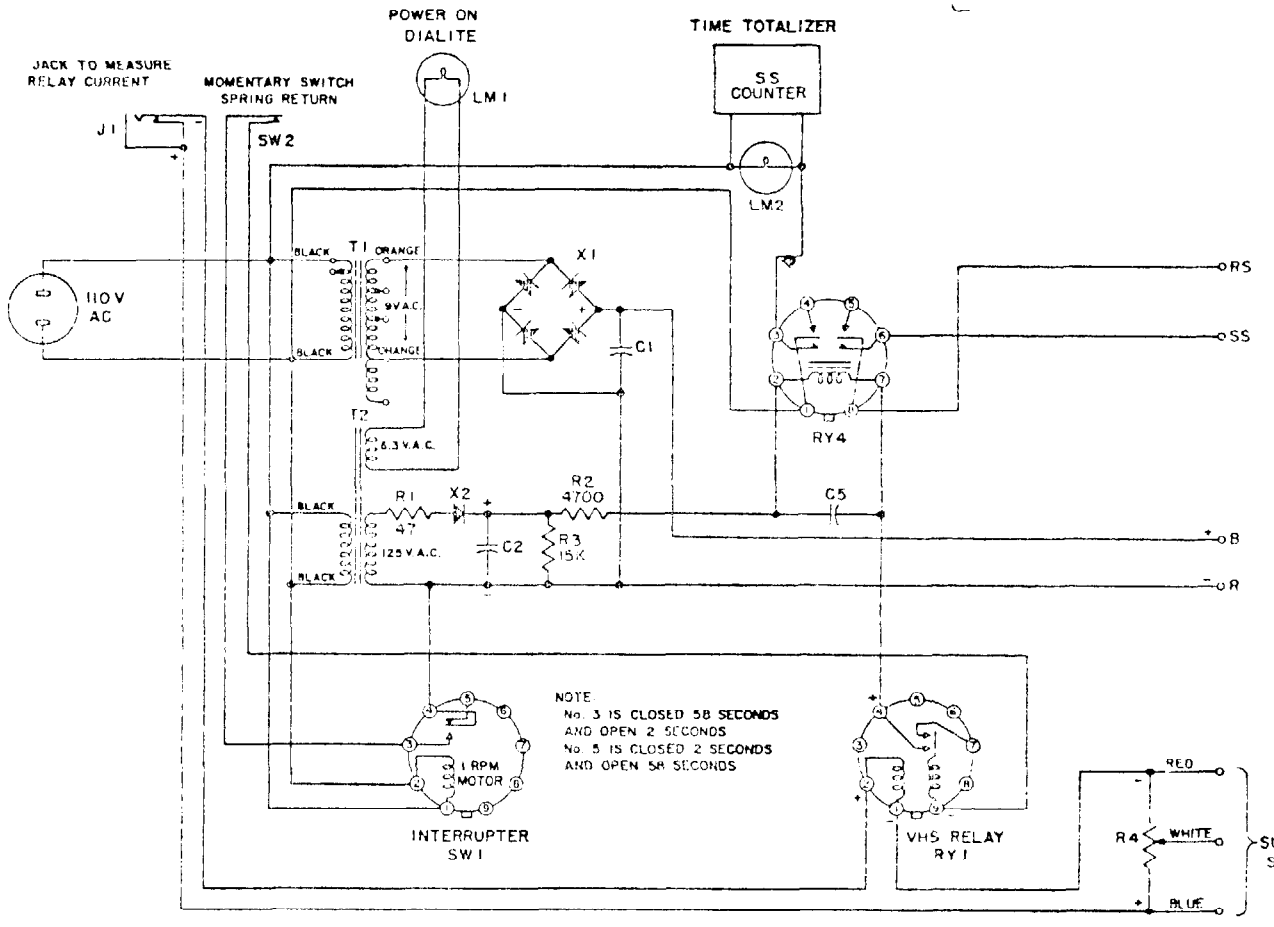
As a rule, when the proper adjustment is made, the potentiometer should not again be disturbed; however, it has been found that in some locations It is necessary to readjust the sensitivity setting after the seasonal adjustments of the shade ring are made. When adjustments are complete, the panel snap-in plug should be put back in place to prevent tampering with the setting.

REMARKS

The photoelectric sunshine switch is a great deal more sensitive than the old mercury switch and should turn on considerably earlier in the morning and off later at night than the old type switch. Also, the new switch is practically instantaneous in its response when the sun emerges or disappears behind clouds. In operation, the top photocell is balanced electrically against the bottom cell in uniform light, as exists on cloudy days or from sky light only. However, when the sun appears it shines on the unshaded cell, but the shade ring protects the other cell from its direct rays. When the current due to the unbalanced light mounts to about eight (8) to ten (10) microamperes, the relays are tripped. It should be appreciated that when the sun is shining through fog or smoke when near the horizon, the light under such conditions my not be strong enough to trip the relays and the switch may not operate under these extreme conditions.

PHOTOELECTRIC SUNSHINE SWITCH





PARTS LIST

C1 - 2000 μf - 15 V
C2 - 20 μf - 150 V
C5 - 100 μf - 150 V

R1 - 47 Ω ½ W
R2 - 4700 Ω 2 W
* R3 - 15 K Ω 1 W
R4 - 500 Ω Pot.

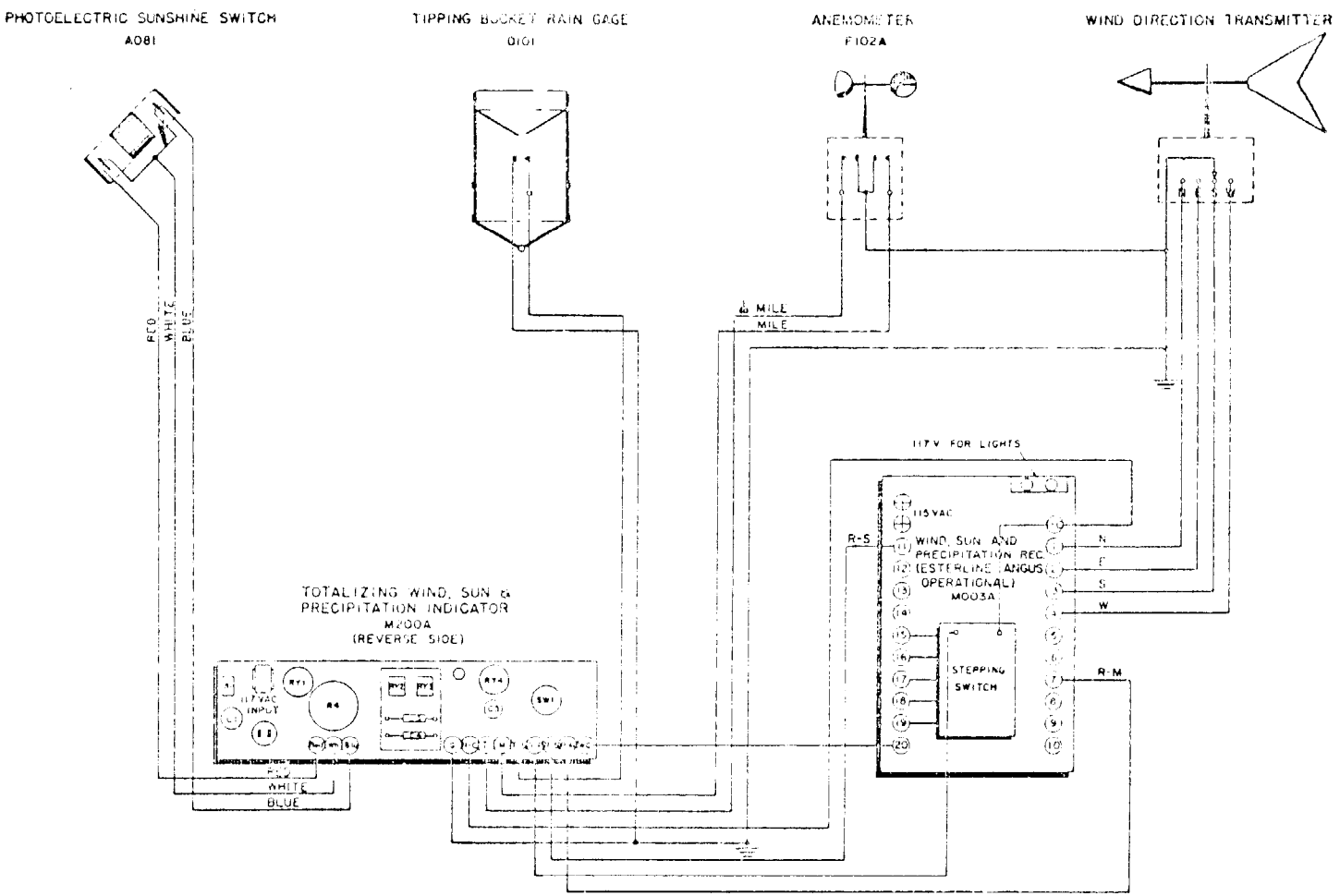
RY1 - VHS RELAY
RY4 - PLUG-IN RELAY

Later Models
* R3 = 30 k 2 w

U.S. DEPT. OF COMMERCE — WASHINGTON 25, D.C.
WEATHER BUREAU
INSTRUMENT DIVISION

PANEL, CONTROL, PHOTOELECTRIC
SUNSHINE SWITCH

REV	DATE	APPROVED BY	DRAWING NO.
A	8-31-56	DRAWN BY W. Y. COMPTON	044.1422/A
		SCALE — N.ONE	DATE FEB. 16, 1956



U.S. DEPT. OF COMMERCE — WASHINGTON 25, D.C.

WEATHER BUREAU

INSTRUMENTAL ENGINEERING DIVISION

METEOROGRAPH SYSTEM,
WIND, SUN, AND PRECIPITATION, WITH TOTALIZING INDICATOR;
ESTERLINE-ANGUS OPERATIONAL RECORDER TYPE,
WEATHER BUREAU DESIGN

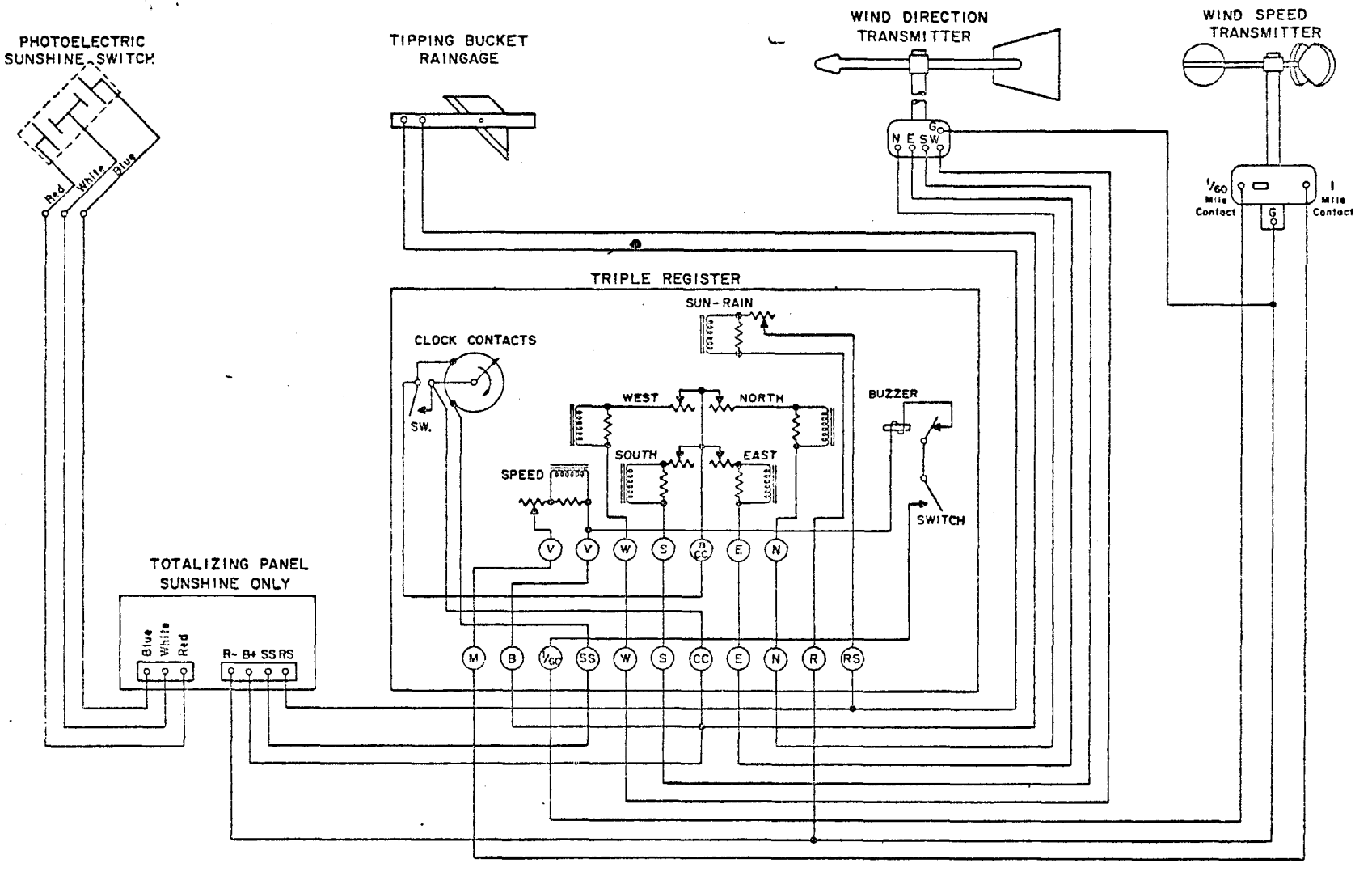
APPROVED BY

DRAWN BY W. K. COMPTON

SCALE None

DRAWING NO. 451.4164/A

DATE APRIL 6, 1955



NOTES:

SHUNT RESISTORS ARE 250Ω. VARIABLE SERIES RESISTORS ARE 20Ω.

VARIABLE RESISTORS SHOULD BE SET DEPENDING ON VOLTAGE SOURCE AND LINE RESISTANCE, TO PRODUCE ABOUT 3 VOLTS ACROSS THE COILS.

POWER IN EARLY TOTALIZING PANELS WITH UNCASED-TRANSFORMERS IS INSUFFICIENT TO OPERATE TRIPLE REGISTER.

U.S. DEPT OF COMMERCE — WASHINGTON, D.C.

WEATHER BUREAU

INSTRUMENTAL ENGINEERING DIVISION

SCHEMATIC DIAGRAM OF TRIPLE REGISTER WITH PHOTOELECTRIC SUNSHINE SWITCH AND PANEL

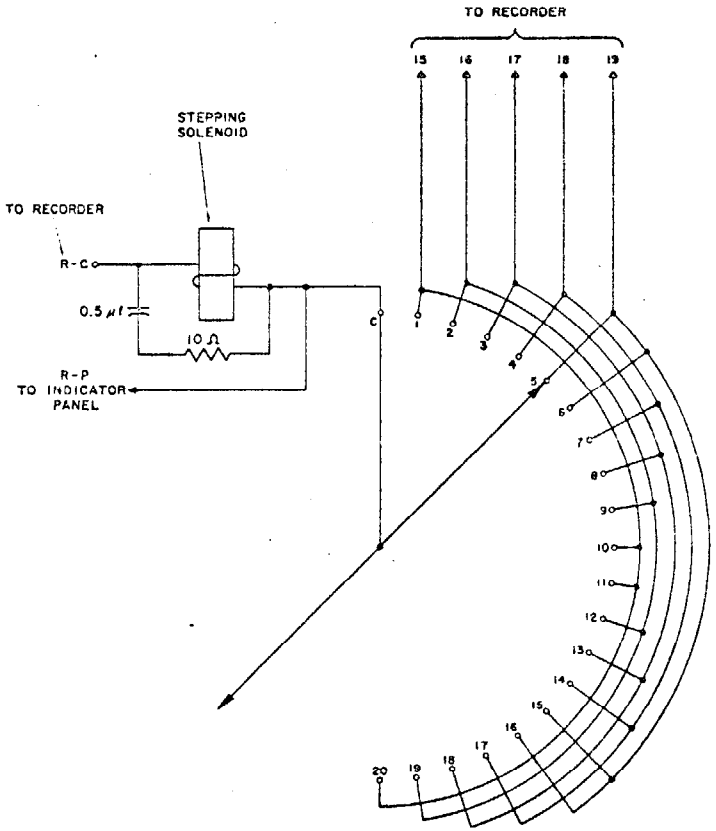
APPROVED BY

DRAWN BY W.V. Compton

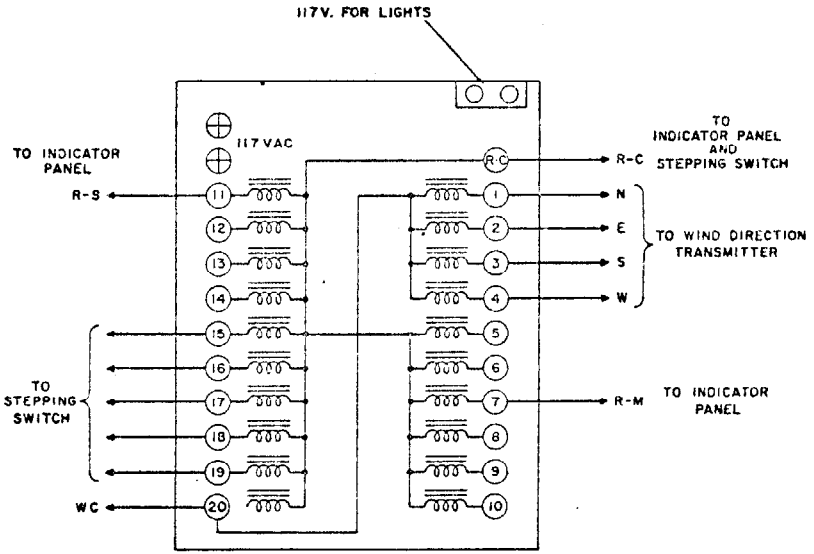
SCALE

DRAWING NO. 451.4166/A

DATE SEPT. 24, 1956



CLARE STEPPING SWITCH
TYPE SD-1



WIND, SUN & PRECIPITATION RECORDER
(ESTERLINE ANGUS OPERATIONAL)
M003A

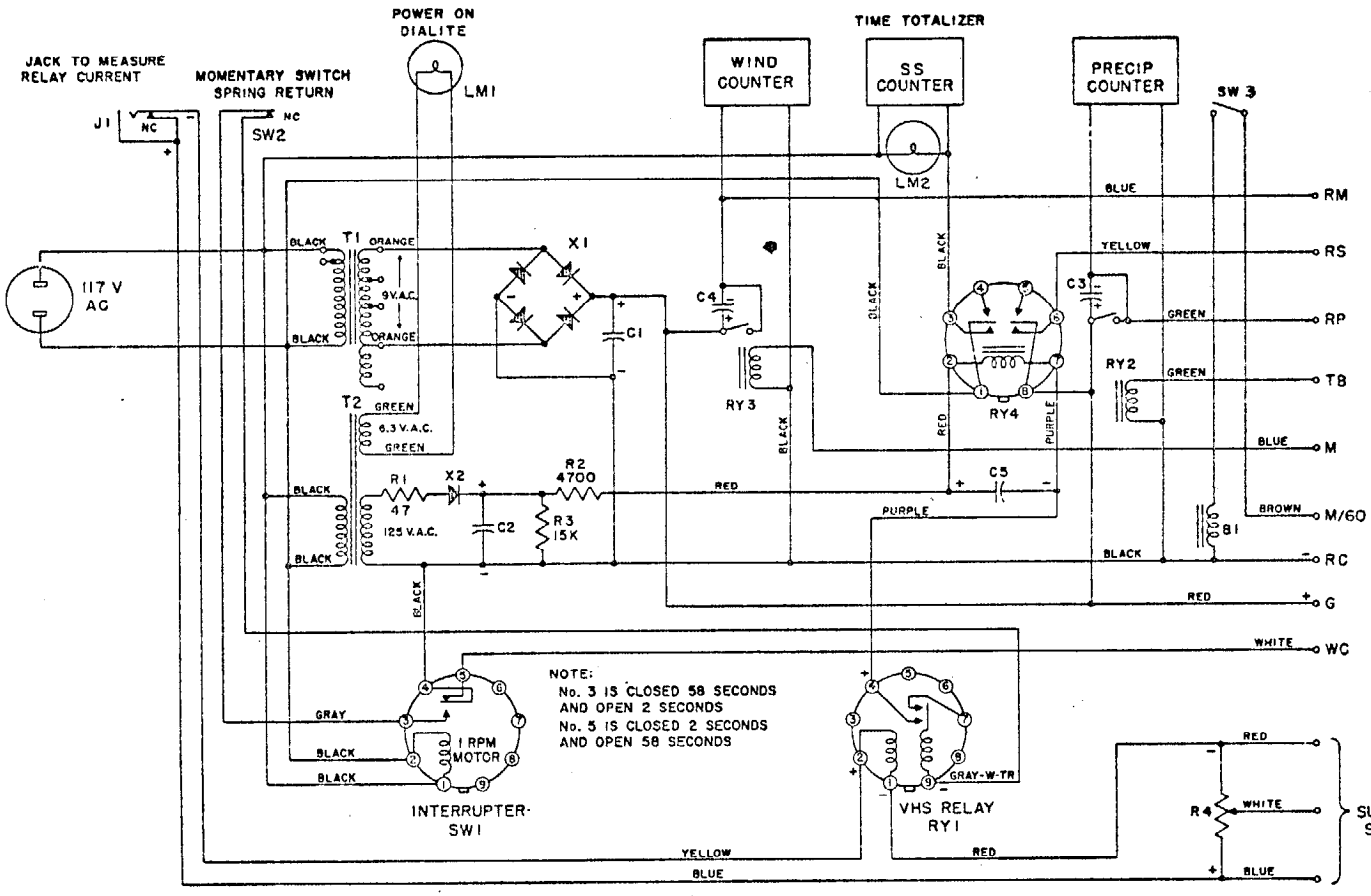
U.S. DEPT. OF COMMERCE — WASHINGTON 25, D.C.

WEATHER BUREAU
INSTRUMENTAL ENGINEERING DIVISION

CIRCUITRY OF MODIFIED
ESTERLINE-ANGUS OPERATIONAL RECORDER
FOR WIND, SUN, AND PRECIPITATION
METEOROGRAPH SYSTEM

APPROVED BY
DRAWN BY W.V. COMPTON
SCALE NONE

DRAWING NO. 451.4164/B
DATE APRIL 6, 1956



PARTS LIST

C1 = 2000 μf - 15V
C2 = 20 μf - 150V
C3 = Condenser, Electrolytic 10 μf, 25VDC
C4 = Condenser, Electrolytic 10 μf, 25 VDC
C5 = 100 μf - 150V

R1 = 47 Ω ½ W
R2 = 4700 Ω 2 W
* R3 = 15K Ω 1W
R4 = 500 Ω Pot.

RY1 = VHS RELAY
RY2 = RELAY 6V. D.P.D.T. SIMILAR TO ADVANCE K1604
RY3 = RELAY 6V. D.P.D.T. SIMILAR TO ADVANCE K1604
RY4 = PLUG-IN RELAY

B1 = 3-6V. BUZZER

T1 = 117V. - 6.3 + 6.3V.
T2 = 117V. - 125V + 6.3V.

X1 = Rectifier fullwave Mallory 1S16C87
X2 = Rectifier halfwave 65ma.

Later Models
* R3 = 30 k 2 w

U.S. DEPT. OF COMMERCE — WASHINGTON 25, D.C.

WEATHER BUREAU
INSTRUMENTAL ENGINEERING DIVISION

CIRCUITRY OF TOTALIZING INDICATOR FOR WIND. SUN AND PRECIPITATION:
ESTERLINE-ANGUS RECORDER TYPE
METEOROGRAPH SYSTEM

APPROVED BY
DRAWN BY W.V.COMPTON
SCALE NONE

drawing no. 451.4164/c
DATE APRIL 6, 1956

NOTES ON SERVICING VARIOUS TOTALIZING PANELS

Theory of Operations: Refer to schematic 044.1422/a, dated Feb. 16, 1956, 451.4164/a, 451.4164/b, AND 451.4164/c, dated Apr. 6, 1956.

There are two panel mounted systems employing identical totalizing circuits and heavy duty 6-volt power supplies.

The first one (sunshine totalizing only) is designed to furnish a 6-volt DC power supply to operate the triple register and the necessary relay circuitry in conjunction with the photoelectric sunshine switch to operate the sunshine circuit of the triple register.

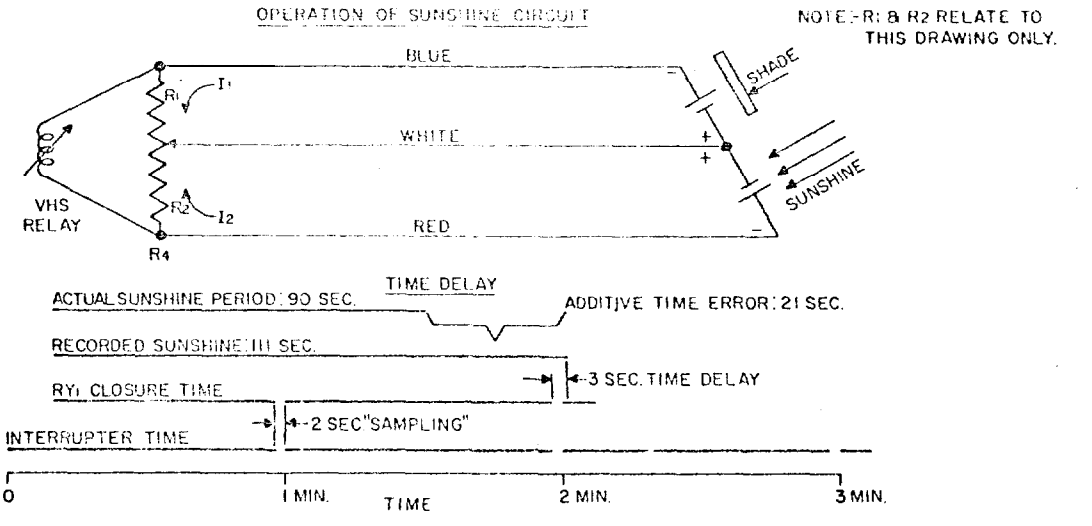
The second panel has the same 6-volt DC power supply, the same relay circuitry for sunshine and; in addition,, two relays and two counters to register precipitation and miles of wind. Also, a buzzer and switch connects the 1/60 mile contact for a rapid check of the wind speed. This function is similar to that employed by the triple register. This second panel is designed to be connected to an operational Esterline-Angus recorder. This 20 pen recorder has been modified to indicate wind direction, wind speed, sunshine and precipitation. The wind direction relays have their common terminal brought out separately to terminal No. 20 so as to be energized once a minute for two seconds. The remaining relays have their common side brought to the common terminal marked RC on the recorder. There is a stepping relay mounted on the back of the recorder, connected to pens 15 thru 19 and so arranged that for each tipping bucket movement, the pens mark a record similar to that of the triple register precipitation record, i.e., pens 15, 16, 17, 18, 19, 19, 18, 17, 16, 15, will mark in that sequence for 10 tips.

The voltage necessary to operate the relays on the E.A. operational recorder is furnished by the 6-volt DC supply in the panel.

Thus, the second panel system replaces the triple register with a modern recorder giving two weeks of continuous record without daily attention.

The photoelectric sunshine switch system operates because of the difference in the amount of light falling on two photocells, both of which are exposed to skylight while one is shaded from direct sunlight. They are so connected and adjusted by R4 that the energy due to skylight cancels only that which is due to sunlight is available to operate the relay circuitry. The two cells are selected to have nearly equal outputs (within 20% of each other) before assembly in the exposure unit.

OPERATION OF SUNSHINE CIRCUIT



Adjustment Notes: Cells shaded from direct sunlight. Potentiometer R4 is adjusted so that no current flows across VHS relay during skylight conditions: $I_1R_1 = I_2R_2$

When sunlight falls on the unshaded dell, its output rises, therefore I_1R_1 is greater that I_2R_2. Since a difference in potential then exists between the two ends of the potentiometer, current flows thru the VHS relay actuating the sunshine circuit.

The polarities are such that since I_2 becomes more negative than I_1 during sunshine, the red lead is said to be negative and the blue positive. Polarities are indicated on schematic where useful. Test: A Simpson 260 multitester set to 100 microamperes, correctly polarized, connected to a phone plug, inserted into the test jack will indicate the VHS relay current directly. In practice it is satisfactory to set the potentiometer so that about 4-6 microamperes flows in VHS relay at skylight (no direct sunlight) condition. This sets the system at maximum sensitivity.

THE SENSITIVE RELAY

The sensitivity relay, Assembly Products Inc. Model VHS, has a moving armature similar to that of a voltreter. The pointer is a contact of solid iridium platinum alloy. A locking coil, integral with the moving element, develops additional torque to drive the contacts together with considerable force.

The signal (control current) flowing thru the signal coil (see figure) turns the moving element to the point of contact. The meter contacts close a circuit thru the load relay coil and the meter locking coil.

INTERRUPTER

In order to "sample" the circuit periodically to determine reception of sunshine, an interrupter (SW1) opens the locking circuit (terminals 3 and 4) once a minute for two seconds. A spring in the VHS contact kicks them apart forcefully. The signal coil then moves to a position relative to the current thru it, (i.e. if sunshine is still being received the contactor will close again).

On the wind sunshine and precipitation panel, the circuitry is arranged so that during the "sampling" period of 2 seconds, terminals 4 and 5 of the interrupter close, energizing the proper wind direction relays in the recorder.

The maximum time error possible due to this type of "sampling" is almost one minute for each sunshine period. This is additive since the operation is practically instantaneous in starting.

TIME DELAY

In order to maintain a continuous sunshine record despite this "sampling" procedure, it is necessary to keep RY4 closed during the time the interruption opens the holding circuit. The combination of C5 and RY4 is chosen to give about three second delay in RY4 dropout. This is sufficient to overlap the two second interruption and maintain continuous record. If sunshine stops, RY4 will drop out after the three second time delay. Chart on preceding page indicates operation.

The test switch on front panel permits immediate checking of sunshine time delay. Under normal conditions, depressing switch for several seconds during sunshine indication will result in sunshine indicator light going off in about three seconds.

WIND AND PRECIPITATION PANEL

The functions of the relays RY2 and RY3 are to operate the panel counters, recorder pens for wind, and the precipitation stepping relays. Each relay (RY2 or RY3) draws only about 250 milliamperes compared with 1.5 amperes for each counter. This low relay current permits a reasonable length of cables to the exposed instruments. The stepping relay for precipitation on back of the recorder also draws about 1.5 amperes.

SERVICE NOTES ON SUNSHINE OR WSP TOTALIZING PANEL

Inspection for obvious faults (such as contact arms bent or broken, loose connections, broken wires, open fuses) is a prerequisite to the following tests:

Test Equipment - Simpson 260 multitester and phone plug

Sunshine Circuit: Refer to Schematic No. 451.4164/A, B, and C, dated Apr. 6, 1956 or Schematic No. 044.1422/A, dated Feb. 16, 1956

Test 1

Sunshine Switch: Disconnect sunshine leads from the panel. Measure current from white to blue and white to red with meter set on the 100 microamperes range. Under bright skylight (no direct sunlight) normal readings would be in order of 20 to 100 microamperes. The two readings should agree within 20%.

Panel Tests: Conditions - Sunshine switch connected, shade ring in proper setting, line cord connected, sun shining, R4 set near middle of range.

Test 2

Connect Simpson meter to phone plug (negative to tip, positive to sleeve) set at 100 microamperes range and plug into test jack. Adjust R4 so current reads slightly more than 10 microamperes. If no current is measured here, examine circuit for breaks or open RY1 (VHS relay). If current is observed. and no sunshine is indicated (either by pilot light or counter) test further If normal, VHS relay should close at about 8 microamperes.

Test 3

Connect a temporary jumper from R or RC to negative of C5 (this bypasses RY1, SW1 and SW2). Sunshine counter and light should operate, if not, test further.

Test 4

Disconnect line cord, remove RY4 and connect pins 1 and 3 of RY4 socket with short wire jumper. Reconnect line cord. Sunshine should be indicated. If not examine sunshine totalizer or sunshine indicator light circuit. Check, back to AC connections on transformer. If the sunshine totalizer is operating during this test, remove jumper from RY4 socket and replace RY4 relay. Check RV power supply with RY4 energized, voltage from RC (or R) to positive terminal of C5 should be about 100 volts; with RY4 not energized, this voltage should be about 150 volts or check RY4, which should measure 10,000 ohms between pins 2 and 7. Replace if necessary

Test 5

If Test No. 3 causes sunshine indicators to operate remove jumper from negative of C5. Connect jumper from R or RC to pin 9 of RY1 socket. (This bypasses SW1 and SW2.) If current indicated by Simpson meter (Test No. 2) is still in excess of 10 microamperes of correct polarity and the sunshine totalizer is still operative, then RY1 is probably defective and should be replaced.

Test 6

If Test No. 5 causes sunshine to be indicated, remove jumper from pin 9 of RY1 and connect jumper from R or RC to pin 3 or SW1. (This bypasses SW1). If this restores the sunshine totalizer to operation, SW1 is defective. If not, SW2 is defective.

TROUBLESHOOTING NOTES

Refer to schematics 451.4614/C, dated Apr. 6, 1956 and 044.1422/A, dated Feb. 16, 1956. L.V. Power Supply Conditions: Line Voltage 117 volts. If voltage drops at terminals G and RC or R and B to less than 6 volts with 3 amperes load, make these tests:

> If voltage on AC side of rectifier remains the same when load is increased from 0 to 3 amperes and DC voltage drops (for example from 8 volts DC to 4 volts DC), either C1 or X1 is defective and should be replaced.. L.V. output should be at least 6 volts at 3 amperes load (2 ohms).

RV Power Supply: Bleeder resistor R3 15K at 1-watt originally furnished on both types of panels (sunshine only and wind, sunshine and precipitation panels) tend to break down and change in value. Subsequent panels, when returned to the CO for repairs, are being furnished with 30K 2-watt resistors R3 position. This resistor allows slightly higher voltages (about volts) unloaded when measured across C2. Operating voltages and currents are discussed under following paragraph.

Sunshine Circuit: RY4 and C5 - normal operation. Under operating conditions, with sunshine indicator on and the Simpson meter connected across C5, observing polarity, will indicate 100 volts. If test switch is held depressed (opening ground return) voltage across C5 drops rapidly. At about 12 to 15 volts (3 or 4 seconds after test switch is depressed) relay RY4 drops out, cutting off indicator light and counter.

RY4 normally draws about 9 milliamperes when closed. (Some relays will not hold closed for more than 2 seconds because of excessive spring tension.) Under average conditions C5 will hold RY4 closed about 3 seconds when SW1 or SW2 is opened.

Interrupter: It is desirable to keep the 2-second closure between terminals 4 and 5 on SW1 accurate to ±1/2 second. Some failures of the snap action switch have been noted. This occurs between terminals 3 and 4 of interrupter socket.

General: Check for leakage between the chassis and the sunshine light socket and X1 rectifier. It may be necessary to insulate this rectifier from the chassis.

Buzzer: Check from either side to ground. Both terminals should be insulated from the buzzer case. Some buzzers used for replacement are not so insulated. It is important that the panel circuitry be isolated above ground, particularly the sunshine circuit.

MAINTENANCE SCHEDULE INDEX
H083 HYGROTHERMOMETER SYSTEMS

Date of Issue	Title
October 28, 1986	Maintenance Schedule Change for the HO83 Hygrothermometer System
April 14, 1987	Errata Sheet No. 1 to Maintenance Schedule for the HO83 Hygrothermometer System
March 5, 1990	Errata Sheet No. 2 Pen and Ink Changes to the HO83 Maintenance Schedule

All previous schedules have been deleted.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

September 18, 1985 W/OTS141 - WDH

TO: All NWS Regional Headquarters, Area Electronics Supervisors, and Electronics Technicians (EHB-8 Distribution)

FROM: W/OTS1 - J. Michael St. Clair

SUBJECT: Transmittal Memorandum for EHB-8, Issuance 85-3

1. Material Transmitted:

Engineering Handbook No. 8, Surface Equipment, Section 4.4, Maintenance Schedule for HO83 Hygrothermometer System.

2. Summary:

The attached maintenance schedule establishes periodic maintenance actions required for the HO83 Hygrothermometer System. The schedule outlines the minimum requirements necessary to ensure dependable operation and accurate data collection. If local conditions cause excessive problems, the schedule should be modified so that the required level of system performance is maintained.

Two copies of the Meteorological Technician's portion (printed on green paper), and one copy of the Electronics Technician's portion (printed on yellow paper) are attached. One copy of the Meteorological Technician's portion should be removed and provided to the Station Manager for incorporation into the Station Duty Manual.

3. Effect on Other Instructions:

Since the HO83 System replaces older Hygrothermometer Systems (H060, H061, HU62, and H063), the maintenance schedule for those systems will be deleted after all such systems have been replaced.

MAINTENANCE SCHEDULE FOR HO83 HYGROTHERMOMETER
(for Meteorological Technicians)

DAILY

What to Check	How to Check	Precautions & Remarks
1. Displays	Depress the DISPLAY TEST switch on the front panel of the HO83 Display Unit.	All light segments of each of the four displays should illuminate, indicating -188.8 and the Error Indicator should flash.
2. Dimmer	Rotate the DIMMER control.	All four displays should vary in brightness from very dim to full illumination. NOTE: Decimal point is not affected by this action.
3. Celsius Mode	Depress the CELSIUS DISPLAY switch.	All four displays should indicate in degrees Celsius while the switch is held. Indication will return to degrees Fahrenheit when the switch is released.
4. Max/Min	Depress the CELSIUS DISPLAY switch and the MAX/MIN RESET switch simultaneously.	The MAX and MIN displays should assume the current value of the ambient temperature (±O.2°). (NOTE: This test should normally be accomplished at regular observation times for Max and Min temperature readings.)

NOTE: Log any irregularities in equipment operation on WS Form A-23.

MAINTENANCE SCHEDULE FOR HO83 HYGROTHERMOMETER
(for Meteorological Technicians)

WEEKLY

What to Check	How to Check	Precautions & Remarks
1. Comparison	Make a comparison check in accordance with FMH-1. The check should be done around noon, using a standard back-up psychrometer (sling or shelter).	Ambient temperature limits are ±1.8°F. Refer to the table below for tolerances required in dewpoint comparisons. If tolerances are exceeded, notify el tech.
2. Display Panel	Clean the front panel of the Display Unit with a soft, lint-free cloth.	

TABLE 1 - H083 DEWPOINT COMPARISON TOLERANCE CHART

(this table provides maximum allowable dewpoint accuracy tolerances in each of three temperature ranges)

Temp-D.P. Spread (°F)	DP ABOVE 32°F Allowable Error (°F)	DP 32° to -0.4°F Allowable Error (°F)	DP -0.5° to -31°F Allowable Error (°F)
0 to 11.7	± 2.0	± 3.4	± 4.5
11.8 to 15.3	± 2.2	± 3.4	± 4.5
15.4 to 17.1	± 2.3	± 3.6	± 4.5
17.2 to 18.9	± 2.5	± 3.8	± 4.5
19.0 to 20.7	± 2.7	± 4.1	± 4.5
20.8 to 22.5	± 2.9	± 4.5	± 4.5
22.6 to 24.3	± 3.1	± 5.0	± 5.0
24.4 to 26.1	± 3.2	± 5.4	± 5.4
26.2 to 27.9	± 3.4	± 5.8	± 5.8
28.0 to 29.7	± 3.6	± 6.3	± 6.3
29.8 to 33.3	± 3.8	± 6.7	± 6.7
33.4 to 40.5	± 4.5	± 7.9	± 7.9
40.6 to 49.5	± 5.6	± 7.9	± 7.9
49.6 to 58.5	± 6.8	± 11.9	± 11.9
58.6 to 63.0	± 7.9	± 13.9	± 13.9

MAINTENANCE SCHEDULE FOR HO83 HYGROTHERMOMETER
(for Electronics Technicians)

MONTHLY

What to Check	How to Check	Precautions & Remarks
Cleaning at Aspirator		
1. Housing (Shell)	Remove Sensor Package (1A1) and thoroughly clean the interior of the Aspirator Shell.	Refer to Section IV of FOMM, Volume I, for detailed procedures.
2. Sensor Package	Carefully wipe (or blow) away all dirt and other foreign matter from the surface of the Sensor Package.	
3. Mirror Surface	Thoroughly clean the mirror surface, using a Freon or alcohol cleaner. Allow to air dry and reexamine for contaminants. Clean again if necessary.	Use care when wiping the mirror surface. DO NOT TOUCH THE MIRROR WITH ANY ABRASIVE MATERIAL!
Replace the Sensor Package in the housing and secure it firmly.		
Comparison		
NOTE: This procedure is required whenever the mirror is cleaned, or if any adjustments have been made.		
	At the sensor location, make a comparison check.	Ambient temperature limits are ±1.8°F. Dewpoint limits are detailed in Table 1 of the Operator's section of this Maintenance Schedule.

MAINTENANCE SCHEDULE FOR HO83 HYGROTHERMOMETER
(for Electronics Technician)

MONTHLY

What to Check	How to Check	Precautions & Remarks
Error Indication		
1. Heat Mode	At transmitter, hold HEAT/COOL switch in HEAT position.	Have an observer at Display Unit verify that Error Indicator flashes.
2. Signal Line	Disconnect input signal (P1) at Display Unit.	Error Indicator should flash. Displays should retain last set of updated data.
3. Instantaneous Mode	Place AVERAGE/INST switch in INST position.	Error Indicator should flash.

QUARTERLY

Optic Bridge Adjustment		
NOTE: Ensure that monthly aspirator cleaning has been accomplished prior to alignment of the optic loop.		
1. Monitor Ta and Td values	Observe and note the Ambient (Ta) and Dewpoint (Td) values on the MONITOR Display. (These are Fahrenheit values.)	Verify the CALIBRATOR switch is in OPERATE position.
2. Direct Sensor (Sd) Gain (R21)	With MONITOR DISPLAY switch in the Td position, place (and hold) the HEAT/COOL switch in the HEAT position. When the Sd LED (CR5) illuminates, adjust R21 (direct sensor) CCW until the LED just extinguishes.	The Td value on the display should rise at a rate of about 2°/second.

MAINTENANCE SCHEDULE FOR HO83 HYGROTHERMOMETER
(for Electronics Technician)

QUARTERLY

What to Check	How to Check	Precautions & Remarks
	Then readjust R21 CW until CR5 is at the threshold of illumination (flickering). Release the HEAT switch.	Allow the Td display value to stabilize.
3. Indirect Sensor (Si) Gain (R22)	Adjust R22 (Indirect Sensor) CW until the Si LED (CR9) just illuminates. Then, carefully readjust R22 until CR9 just goes out.	Allow the Td display value to stabilize.
4. Verify Limits	Verify that both LIMIT LEDS (CR6 and CR7) are OFF.	The Sd LED (CR5) should be at threshold (flickering), and the Si LED (CR9) should be ON.
Calibrator Tests		
1. O° Celsius	Place CALIBRATOR switch in the "0" position and observe the Ta and Td values on the MONITOR DISPLAY. Both should read 32.0 (±O.2).	Adjust TAO (R35) for Ta. Adjust TDO (R52) for Td.
2. +50° Celsius	Place CALIBRATOR switch in the "+50" position and observe the Ta and Td values on the MONITOR DISPLAY. Both should read 22.0 (±0.2).	Adjust TA+ (R34) for Ta. Adjust TD+ (R51) for Td.
3. Verify Span	Place CALIBRATOR switch in the "0" position and observe Ta and Td. Verify that both read 32.0 (±O.2).	If not within limits, repeat steps 1 and 2 above.

MAINTENANCE SCHEDULE FOR HO83 HYGROTHERMOMETER
(for Electronics Technicians)

QUARTERLY

What to Check	How to Check	Precautions & Remarks
	Place CALIBRATOR switch in the "-50" position and observe Ta and Td. Verify that Ta reads -58.0 (±0.2) and Td reads -67.7 (±0.5). Return CALIBRATOR switch to OPERATE position.	
CLEANING		
1. Transmitter Unit	Thoroughly clean interior of Transmitter Unit.	
2. Display Unit	Thoroughly clean interior of Display Unit.	

SEMI-ANNUAL

1. Power Supplies	At the Display Unit, measure the supply voltage at 3A2-6, using a DVM.	Should indicate +5.OV (±0.5V).
	At the Transmitter Unit, use a DVM to measure the three supplies as follows:	Prescribed Limits:
	+5V at 2A3-10	+5.0 Vdc (±0.5V)
	+12V at 2A3-6	+12.0 Vdc (±0.5V)
	-12V at 2A3-12	-12.0 Vdc (±0.5V)

MAINTENANCE SCHEDULE FOR THE H083 HYGROTHERMOMETER
(for Electronics Technicians)

SEMI-ANNUAL

What to Check	How to Check	Precautions & Remarks
2. Calibrator Max/Min	At the Display Unit, reset the MAX/MIN displays by depressing the Celsius DISPLAY and MAX/MIN RESET switches simultaneously,	Verify that both max and min displays assume the current value of Ta.
	At the Transmitter Unit, place the CALIBRATOR switch in the "+50" position.	Wait six (6) minutes.
	Place the CALIBRATOR switch in the "-50" position.	Wait six (6) minutes.
	Place the CALIBRATOR switch in the "OPERATE" position, and return to the Display Unit.	Verify that the Tmax and Tmin display values are 122.0 and -58.0
3. Power and Signal Lines	Ensure that power (115 VAC) connections at TB1 in the transmitter are not corroded, and are firmly secured to the terminal board. Measure line voltage.	Voltage should be 115 VAC (±*10%).
	Inspect the data pair for corrosion and proper connection at TB2 in the transmitter unit.	

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910 W/OS0321 - WDH

April 14, 1987

TO: All NWS Regional Headquarters, Area Electronics Supervisors, and Electronics Technicians (EHB-8 Distribution)

FROM: W/OS03 - J. Michael St. Clair

SUBJECT: Transmittal Memorandum for Engineering Handbook No. 8, Issuance 87-4

1. Material Transmitted:

Engineering Handbook No. 8, Surface Equipment, Section 4.8 Errata Sheet No. 1 to Maintenance Schedule for the HO83 Hygrothermometer System.

2. Summary:

Errata Sheet No. 1 provides pen-and-ink changes to the HO83 Maintenance Schedule.

3. Effect on Other Instructions:

None.

EHB-8
Issuance 87-4

Errata Sheet No. 1 to HO83 Maintenance Schedule

HO83 Maintenance Schedule, page 6, under PRECAUTIONS AND REMARKS, 6 lines down: Step 10 should read Step 7.

ERRATA SHEET 2 (for Electronics Technicians)
Engineering Division
W/OS0321:BGM

Pen-and-ink changes to the HO83 Maintenance Schedule

General:

1. The purpose of this errata sheet No. 2 is to provide pen-and-ink changes to the quarterly HO83 maintenance schedule, section 4.4.

Effect on Other Instructions:

2. None.

Procedure:

1. Page number 4, Step 10 (Power Supply Voltage Checks) make the following changes.

   a. Change TB1 to TB1 between 1 and 3 (120VAC)
   b. Change 2A3-10 to 2X1-6 (+5VDC)
   c. Change 2A3-6 to 2X3-6 (+12VDC)
   d. Change 2A3-12 to 2X3-12 (-12VDC)

2. Page number 7, Step 13 (Transmitter Calibration)

   a. Change R14 on line number 3 to R35
   b. Change R16 on line number 7 to R34
   c. Change R15 second paragraph line number 6 to R52
   d. Change R17 second paragraph line number 7 to R51

J. Michael St. Clair
Chief, Engineering Division

3-5-90

MAINTENANCE SCHEDULE INDEX - LASER BEAM CEILOMETER

Date of Issue	Title
March 29, 1991	Maintenance Schedule for Laser Beam Ceilometer and Associated Equipment

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

W/OS0321:WDH

March 29, 1991

MEMORANDUM FOR: All NWS Regional Headquarters, Area Electronics Supervisors, and Electronics Technicians (EHB-8 Distribution)

FROM: W/OS03 - J. Michael St.Clair

SUBJECT: Transmittal Memorandum for Engineering Handbook (EHB) No. 8 Issuance 91-3

1. Material Transmitted:

EHB-8, Surface Equipment, Section 4.1, Maintenance Schedule for Laser Beam Ceilometer and associated equipment.

2. Summary:

This maintenance schedule is for the use of all personnel in the operation and maintenance of the laser beam ceilometer and associated equipment. It comprises the minimum periodic checking and servicing considered necessary to assure dependable operation. If local conditions warrant, more frequency checks should be made. Two copies of the meteorological technician's portion and one copy of the electronics technician's portion should be attached to each copy of the transmittal memorandum. The meteorological portion is printed on green paper, the electronics technician portion on yellow paper. One copy of the meteorological portion of the schedule should be detached and given to the MIC/HIC/OIC to be inserted in the station duty manual, Volume 2.

3. Effect on Other Instructions:

These instructions supplement the preventive maintenance instructions in the laser ceilometer equipment manual.

MAINTENANCE SCHEDULE FOR LASER BEAM CEILOMETER
(For Electronics Technicians)

QUARTERLY

What to Check	How to Check	Precautions & Remarks
Data Message		
1. Alarms	Check that the data message contains no alarms.	See paragraph 6.1.1 in manual (page 267).
Window Conditioner		
1. Blower	Observe the performance of the window conditioner blower by listening to its sound and feeling the air flow to detect signs of wear.	See paragraph 5.3 in manual (page 262) for additional tests.
Equipment Cover		
1. Cleanliness	Inspect the cleanliness of the ceilometer windows. If they are definitely unclean (e.g., film, streaks, or particles) perform cleaning as detailed in paragraph 5.2 (page 261) of the manual.	WARNING: If the power to the ceilometer is on, do not look into ceilometer optics with magnifying glass, binoculars, or other magnifying optics when performing the cleaning procedure.

NOTE: The latest technical manual from Vaisala is the revision "E" which supersedes all others. The revision "E" designation may be found at the top of page iii of the manual.

Engineering Division.
W/OS0321:WDH

MAINTENANCE SCHEDULE FOR LASER BEAM CEILOMETER
(For Electronics Technicians)

What to Check	How to Check	Precautions & Remarks
QUARTERLY		
2. Light Monitor Board	Inspect visually for obstructions between photodiodes Dl and D3 and their respective light sources.	See paragraph 6.2.4 (page 288) in manual.
Heater/Blower Sub-Assembly		
1. Heater Foil	Check resistance of heater foil. Disconnect window conditioner cable resistance between (B1). check pins B & C of plug (J2) .	+5 If reading is 22-ohms, return to service. If reading is open or higher than 22 ohms, replace heater foil.
2. Rubber Foam Strips (Item #10 on page 230 of manual)	Check thickness of rubber foam strips located on underside of heater subassembly base plate. Replace if compressed or worn. Replace using NWS part no. K220-1B1MP1.	Brown burn marks on top of equipment cover may indicate that rubber foam strips need to be replaced.

MAINTENANCE SCHEDULE FOR LASER BEAM CEILOMETER
(For Electronics Technicians)

ANNUALLY		
What to Check	How to Check	Precautions & Remarks
Window Conditioner		
1. Obstructions	Remove the heater/blower subassembly and inspect for insects or other debris, especially at the blower exhaust screen.	Be aware of sharp edges on subassembly screens.

MAINTENANCE SCHEDULE FOR LASER BEAM CEILOMETER
(For Meteorological Technicians)

DAILY

What to Check	How to Check	Precautions & Remarks
Gifft Recorder		
1. Darkness Control	Check for background noise levels of no more than a light gray. The signal level should be dimly lit.	If the darkness control is set too high, stylus life will be diminished.
2. Fine Scale Switch	Depress and verify proper operation.	
3. Time Light and Set Switches.	Verify time light is on and the correct time and angle marks are being printed. Reset if necessary.	See set procedure (below).
4. Projector OK Light	Note status and notify technician if blinking or out.	

TIME/LIGHT SET PROCEDURE

TIME SET SWITCHES: When the correct time agrees with the setting of the time thumbwheel switches, depressing the fine scale and fast paper switches simultaneously will cause the corrected time to be loaded into internal clock. Both switches are connected in an interlock fashion such that pushing any one switch will not upset any previously set time.

TIME OK LIGHT: The TIME OK light comes on when the time is set by pushing the fine scale switch and the fast paper switch simultaneously. When this light is on, the time printed on the chart is correct since the- last correct time was loaded. If power should fail, or if the system is turned off, the light will go out, signifying that the internal clock is in error. When this condition exists, the time and angle numerals are omitted from the recording so that faulty time readings are not interpreted from the data, Thus, if the numerals are omitted and the light is off, the correct time should be reset.